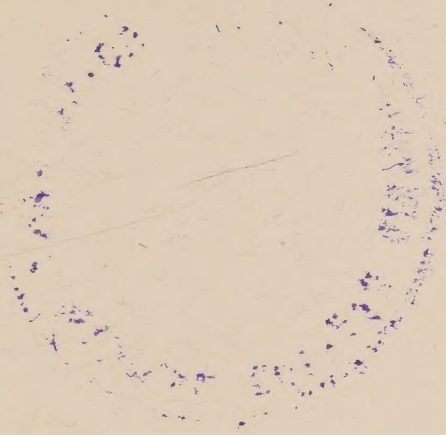


22101957147





The island of Graciosa, Azores

B.R. 502 c (RESTRICTED)

GEOGRAPHICAL HANDBOOK SERIES

FOR OFFICIAL USE ONLY

SPAIN & PORTUGAL

VOLUME IV

THE ATLANTIC ISLANDS

JANUARY 1945

NAVAL INTELLIGENCE DIVISION

*This book is for the use of persons in
H.M. Service only and must not be
shown, or made available, to the Press
or to any member of the public.*

TRO
RAMC
CH.
/GRE

Information subsequent to the grant of facilities
in the Azores by Portugal to the Allies in October
1943 is generally excluded from this volume.

PREFACE

IN 1915 a Geographical Section was formed in the Naval Intelligence Division of the Admiralty to write Geographical Handbooks on various parts of the world. The purpose of these handbooks was to supply, by scientific research and skilled arrangement, material for the discussion of naval, military, and political problems, as distinct from the examination of the problems themselves. Many distinguished collaborators assisted in their production, and by the end of 1918 upwards of fifty volumes had been produced in Handbook and Manual form, as well as numerous short-term geographical reports. The demand for these books increased rapidly with each new issue, and they acquired a high reputation for accuracy and impartiality. They are now to be found in Service Establishments and Embassies throughout the world, and in the early years after the last war were much used by the League of Nations.

The old Handbooks have been extensively used in the present war, and experience has disclosed both their value and their limitations. On the one hand they have proved, beyond all question, how greatly the work of the fighting services and of Government Departments is facilitated if countries of strategic or political importance are covered by handbooks which deal, in a convenient and easily digested form, with their geography, ethnology, administration, and resources. On the other hand it has become apparent that something more is required to meet present-day requirements. The old series does not cover many of the countries closely affected by the present war (e.g. Germany, France, Poland, Spain, Portugal, to name only a few); its books are somewhat uneven in quality, and they are inadequately equipped with maps, diagrams, and photographic illustrations.

The present series of Handbooks, while owing its inspiration largely to the former series, is in no sense an attempt to revise or re-edit that series. It is an entirely new set of books, produced in the Naval Intelligence Division by trained geographers drawn largely from the Universities, and working at sub-centres established at Oxford and Cambridge, and is printed by the Oxford and Cambridge University Presses. The books follow, in general, a uniform scheme, though minor modifications will be found in particular cases; and they are illustrated by numerous maps and photographs.

The purpose of the books is primarily naval. They are designed first to provide, for the use of Commanding Officers, information in

a comprehensive and convenient form about countries which they may be called upon to visit, not only in war but in peace-time; secondly, to maintain the high standard of education in the Navy and, by supplying officers with material for lectures to naval personnel ashore and afloat, to ensure for all ranks that visits to a new country shall be both interesting and profitable.

Their contents are, however, by no means confined to matters of purely naval interest. For many purposes (e.g. history, administration, resources, communications, &c.) countries must necessarily be treated as a whole, and no attempt is made to limit their treatment exclusively to coastal zones. It is hoped therefore that the Army, the Royal Air Force, and other Government Departments (many of whom have given great assistance in the production of the series) will find these handbooks even more valuable than their predecessors proved to be both during and after the last war.

J. H. GODFREY

Director of Naval Intelligence

1942

The foregoing preface has appeared from the beginning of this series of Geographical Handbooks. It describes so effectively their origin and purpose that I have decided to retain it in its original form.

This volume has been prepared by the Oxford sub-centre of the Naval Intelligence Division under the direction of Lieut.-Colonel K. Mason, M.C., M.A., R.E., Professor of Geography in the University of Oxford, and has been written mainly by R. P. Beckinsale, M.A., Sheila De Sa, B.A., and E. W. Gilbert, B.Litt., M.A., Reader in Human Geography in the University of Oxford.

E. G. N. RUSHBROOKE

Director of Naval Intelligence

JANUARY 1945

CONTENTS

PART I. GENERAL DESCRIPTION

I. INTRODUCTION	3
Position (1)—Area and Population (6)—Relief, Climate, and Vegetation (6)—Economic Resources (7)—Ports (7)—Relations with Great Britain (7)—Strategic Position (8)—Arrangement of Volume (9).	
II. GENERAL PHYSICAL AND GEOLOGICAL DESCRIPTION	10
FORMATION (10); NATURE AND STRUCTURE OF THE ROCKS: Igneous (13)—Sedimentary (14)—Blown Sand (15); CHARACTERISTIC LANDFORMS: Volcanic Accumulation (15)—Surface Erosion and Weathering (18)—Marine Erosion (19); RECENT VOLCANIC AND SEISMIC ACTIVITY: The Canaries (20)—Madeira (22)—The Azores (22).	
III. CLIMATE	24
GENERAL FACTORS: Main Pressure and Wind Belts (24)—Ocean Currents (24)—Continental Winds (25)—Local Topographic Effects (26). GENERAL ACCOUNT: Atmospheric Pressure (26)—Winds (27)—Temperature (30)—Relative Humidity (32)—Cloudiness (32)—Precipitation (35)—Visibility (37)—Rough Sea and Swell (38).	
IV. FLORA AND FAUNA	39
FLORA: Affinities and Origin (39)—Abundance and Composition (41)—Vertical Distribution (42)—Main Zones in Tenerife (42)—Forest and Woodland (46). FAUNA: Affinities, Origin, and Abundance (47)—Composition and Geographical Distribution (48).	
V. HISTORY	52
THE CANARIES (52): Discovery and Early Expeditions (53)—Bethencourt's Expeditions (55)—Portuguese Expeditions (56)—Spanish Conquest (57)—Spanish Rule (58)—Nelson in Tenerife (59)—Recent History (60). MADEIRA: Discovery (60)—Settlement (62)—British Relations with Madeira (64)—Recent History (65). THE AZORES: Discovery (66)—Settlement (67)—Spanish Rule, 1580-1640 (70)—English Raids (70)—The Fight of the <i>Revenge</i> (71)—Recent History (75).	
VI. ADMINISTRATION AND PUBLIC HEALTH	78
ADMINISTRATION: The Canaries (78)—Madeira (79)—The Azores (79). PUBLIC HEALTH (80): Insect-borne Diseases (81)—Intestinal Diseases (81)—Other Infective Diseases (82)—Hospitals (82).	

VII. THE PEOPLES	83
ABORIGINAL INHABITANTS; THE GUANCHES: Origin (83)—Characteristics (85)—Language (86)—Mode of Life (87)—Religion and Burial Customs (89)—Methods of Government (91)—Survival of Guanche Customs (92).	
MODERN INHABITANTS: The Canaries (92)—Madeira and the Azores (94).	
VIII. COMMERCE	97
THE CANARIES: Imports (97)—Exports (99)—Shipping Lines (99).	
MADEIRA: Imports (100)—Exports (101)—Shipping Lines (102).	
THE AZORES: Imports (103)—Exports (103)—Shipping Lines (104).	
IX. SIGNAL COMMUNICATIONS	106
THE CANARIES: Telephone and Telegraph (106)—Submarine Cables (106)—Wireless Telegraphy, Telephony, and Broadcasting (107).	
MADEIRA: Telephone and Telegraph (108)—Submarine Cables (108)—Wireless Telegraphy, Telephony, and Broadcasting (108).	
THE AZORES: Telephone and Telegraph (109)—Submarine Cables (110)—Wireless Telegraphy, Telephony, and Broadcasting (111).	
PART II. DETAILED DESCRIPTION	
X. THE CANARIES	115
<i>GRAN CANARIA</i> (117).	
PHYSICAL GEOGRAPHY: Relief (117)—Drainage and Water-supply (118)—Vegetation (119)—Coasts (121); HUMAN GEOGRAPHY: Distribution of Population (124)—Industries (130)—Ports (134)—Las Palmas and Puerto de la Luz (134)—Communications (139).	
<i>TENERIFE</i> (142).	
PHYSICAL GEOGRAPHY: Relief (142)—Drainage and Water-supply (144)—Vegetation (147)—Coasts (147); HUMAN GEOGRAPHY: Distribution of Population (150)—Industries (156)—Ports (160)—S. Cruz de Tenerife (160)—Puerto de la Cruz (163)—Communications (164).	
<i>GOMERA</i> (168).	
PHYSICAL GEOGRAPHY: Relief (168)—Drainage and Water-supply (169)—Vegetation (169)—Coasts (171); HUMAN GEOGRAPHY: Distribution of Population (172)—Industries (173)—Ports (174)—S. Sebastián (174)—Communications (175).	

LA PALMA (177).

PHYSICAL GEOGRAPHY: Relief (177)—Drainage and Water-supply (179)—Vegetation (180)—Coasts (181); HUMAN GEOGRAPHY: Distribution of Population (181)—Industries (183)—Ports (184)—S. Cruz de la Palma (185)—Communications (185).

HIERRO (187).

PHYSICAL GEOGRAPHY: Relief (187)—Drainage and Water-supply (187)—Vegetation (188)—Coasts (188); HUMAN GEOGRAPHY: Distribution of Population (189)—Industries (190)—Ports (191)—Communications (191).

FUERTEVENTURA (193).

PHYSICAL GEOGRAPHY: Relief (193)—Drainage and Water-supply (195)—Vegetation (197)—Coasts (197); HUMAN GEOGRAPHY: Distribution of Population (199)—Industries (200)—Ports (201)—Puerto de Cabras (201)—Communications (202).

ISLA DE LOBOS (203).

LANZAROTE (205).

PHYSICAL GEOGRAPHY: Relief (205)—Drainage and Water-supply (207)—Vegetation (208)—Coasts (209); HUMAN GEOGRAPHY: Distribution of Population (210)—Industries (211)—Ports (212)—Puerto de Naos and Puerto de Arecife (212)—Communications (214).

CANARY ISLANDS NORTH OF LANZAROTE (216).

GRACIOSA (216)—MONTAÑA CLARA (218)—ROQUE DEL OESTE (218)—ROQUE DEL ESTE (218)—ALEGRANZA (219).

XI. THE MADEIRA GROUP 221

MADEIRA (223).

PHYSICAL GEOGRAPHY: Relief (223)—Drainage and Water-supply (225)—Vegetation (226)—Coasts (227); HUMAN GEOGRAPHY: Distribution of Population (230)—Industries (234)—Ports (242)—Funchal (242)—Communications (247).

PORTO SANTO (255).

PHYSICAL GEOGRAPHY (255); HUMAN GEOGRAPHY (258).

THE DESERTAS (261).

THE SELVAGENS (264).

XII. THE AZORES 267

S. MARIA (269).

PHYSICAL GEOGRAPHY: Relief (270)—Water-supply and Vegetation (270)—Coasts (271); HUMAN GEOGRAPHY: Distribution of Population (271)—Industries (272)—Communications (272).

THE FORMIGAS ROCKS (273).

S. MIGUEL (274).

PHYSICAL GEOGRAPHY: Relief (274)—Drainage and Water-supply (276)—Vegetation (277)—Coasts (279); HUMAN GEOGRAPHY: Distribution of Population (281)—Industries (285)—Fishing (289)—Ports (290)—Ponta Delgada (290)—Communications (295).

TERCEIRA (302).

PHYSICAL GEOGRAPHY: Relief (302)—Drainage and Water-supply (303)—Vegetation (303)—Coasts (304); HUMAN GEOGRAPHY: Distribution of Population (305)—Industries (306)—Ports (307)—Angra do Heroísmo (307)—Communications (310).

GRACIOSA (313).

PHYSICAL GEOGRAPHY (313); HUMAN GEOGRAPHY (313).

S. JORGE (315).

PHYSICAL GEOGRAPHY (315); HUMAN GEOGRAPHY (316).

PICO (317).

PHYSICAL GEOGRAPHY: Relief (317)—Drainage and Water-supply (318)—Vegetation (320)—Coasts (321); HUMAN GEOGRAPHY: Distribution of Population (322)—Industries (322)—Ports and Communications (324).

FAYAL (325).

PHYSICAL GEOGRAPHY: Relief and Water-supply (325)—Vegetation (326)—Coasts (326); HUMAN GEOGRAPHY: Distribution of Population (327)—Industries (328)—Ports (328)—Horta (329)—Communications (332).

FLORES (334).

PHYSICAL GEOGRAPHY (334); HUMAN GEOGRAPHY (336).

CORVO (337).

APPENDIXES

A. RECENT VOLCANIC AND SEISMIC ACTIVITY IN THE AZORES	340
B. METEOROLOGICAL TABLES	343
Table 1. The Canaries. Orotava (La Paz Botanica)	343
Table 2. Madeira. Funchal	344
Table 3. The Azores. Ponta Delgada	345
C. EXTERNAL TRADE OF THE CANARIES, 1933	346
D. WIRELESS (W/T) AND RADIO (R/T) STATIONS IN THE CANARIES, MADEIRA, AND THE AZORES IN SEPTEMBER 1942	348
E. BIBLIOGRAPHICAL NOTE	352

INDEX	355
-----------------	-----

LIST OF FIGURES

1. The Atlantic Islands	3
2. The Canaries	4
3. The Madeira Group	5
4. The Azores	5
5. The Ocean Depths off the Azores	11
6. The Geological Structure of Tenerife	12
7. Mean Monthly Pressure and Winds	27
8. Mean Monthly Temperatures	31
9. Mean Annual Cloudiness and Rainfall	33
10. Cross-section of main Climatic and Vegetation Zones of Tenerife	34
11. The Vegetation of Tenerife	43
12. Probable movement of Fleets before the Fight of the <i>Revenge</i> , 1591	73
13. Traditional Azorean form of Headgear	96
14. The Signal Communications of the Canaries	107
15. The Signal Communications of the Madeira Group	109
16. The Signal Communications of the Azores	111
17. The Canaries	115
18. Relief of Gran Canaria	<i>facing</i> 117
19. Gran Canaria from the south-east	118
20. Vegetation Regions of Gran Canaria	120
21. Plan of Las Palmas	137
22. Communications and Settlements of Gran Canaria	<i>facing</i> 140
23. Relief of Tenerife.	„ 143
24. Water-supply of Tenerife	145
25. Plan of S. Cruz de Tenerife	161
26. Communications and Settlements of Tenerife	<i>facing</i> 166
27. Gomera	170
28. La Palma	178
29. Hierro	188
30. Fuerteventura	194
31. Lanzarote and its outlying Islets	206
32. Plan of Arrecife	213
33. Graciosa (Canaries)	217
34. The Madeira Group	221
35. Relief of Madeira	<i>facing</i> 223
36. Madeira from the east-south-east	228
37. Plan of Funchal	244
38. Communications and Settlements of Madeira	<i>facing</i> 254

39. Porto Santo	256
40. Porto Santo from the north-west	257
41. The Desertas	262
42. The Desertas from the north-west	263
43. Selvagem Grande	264
44. Selvagem Pequena and Ilhéu de Fora	265
45. The Azores	267
46. S. Maria	269
47. S. Miguel	<i>facing</i> 273
48. Plan of Ponta Delgada	292
49. Terceira	<i>facing</i> 301
50. Plan of Angra do Heroismo	308
51. Graciosa (Azores)	314
52. S. Jorge	<i>facing</i> 315
53. Pico	„ 317
54. Fayal	„ 325
55. Plan of Horta	330
56. Flores and Corvo	335

LIST OF PHOTOGRAPHS

The Island of Graciosa, Azores	<i>frontispiece</i> <i>facing</i>
1. Sand Dunes in Puerto de la Luz, Gran Canaria	16
2. The Island of Pico seen from Fayal	16
3. The Caldeira of Fayal from the north-east	17
4. Caldera de Bandama, Gran Canaria	17
5. Caldeira, Corvo	18
6. Recent Lava-flow in Gran Canaria	18
7. Ribeira Brava, Madeira from the sea	19
8. Ribeira Brava Valley from the north	19
9. Islets off Mosteiros, S. Miguel	22
10. Lava Stream forming Cliffs at Ponta do Misterio, Terceira	22
11. Hot Springs at Furnas, S. Miguel	23
12. Coastal Platform at Victoria, Graciosa (Azores)	23
13. Wooded Slopes above Lagoa das Furnas, S. Miguel	40
14. <i>Euphorbia canariensis</i> near Juan Grande, Gran Canaria	40
15. Banana Plantation, Madeira	41
16. Woods of the Ribeiro Frio, Madeira	41
17. Grassy Summit near Poiso, Madeira	46
18. Forest on the Slopes of Pico de Teide, Tenerife	46
19. Canary Pines near Agaete, Gran Canaria	47
20. A Dragon Tree in Tenerife	47
21. Guanche Cave-dwellings in Gran Canaria	94
22. Women wearing the <i>Capote</i> at Horta, Fayal	94
23. Carts in the Outskirts of Angra do Heroismo, Terceira	95
24. Carrying Wine in Goat-skins, Madeira	95

GRAN CANARIA

25. Barranco de Tirajana at S. Bartolomé	122
26. The Telde Valley	122
27. Roque Nublo, Gran Canaria	123
28. Peasant's House, Gran Canaria	123
29. Arguinequin	124
30. Coast of Gran Canaria at Bañaderos	124
31. Gáldar	125
32. Arucas	125
33. Reservoirs in Gran Canaria	134
34. Irrigation Channel and Banana Plantation, Gran Canaria	134

Gran Canaria (*cont.*)

35. Puerto de la Luz	135
36. Puerto de la Luz	135
37. Puerto de la Luz	138
38. Dry River Bed in Las Palmas	138
39. Main Road near Tejeda	139
40. Tunnel on Las Palmas—Telde Road	139

TENERIFE

41. Pico de Teide	148
42. Pico de Teide from Icod	148
43. S. Andrés, Tenerife	149
44. Coast of Tenerife near Puerto de la Cruz	149
45. La Laguna	152
46. Garachico	152
47. Puerto de la Cruz	153
48. The Orotava Valley	153
49. S. Cruz de Tenerife	162
50. Port of S. Cruz de Tenerife	162
51. Port of S. Cruz de Tenerife	163
52. Banana Plantation, Tenerife	163

GOMERA

53. The Transporter at Peñon	172
54. Banana Plantation in the Valley of Hermigua	172
55. Terraced Banana Plantation at Hermigua Alta	173
56. S. Sebastián	173

LA PALMA

57. Barranco de las Angustias	184
58. Crater near S. Antonio	184
59. Los Llanos	185
60. S. Cruz de La Palma	185
61. Road from Los Llanos to the Gran Caldera	192

HIERRO

62. Puerto del Hierro	192
---------------------------------	-----

FUERTEVENTURA

63. Volcanic Cone near Tetir	193
64. Barranco de Gran Tarajal	193

LANZAROTE

65. Coast of Lanzarote at La Tiñosa	210
66. Vines planted in Volcanic Cinders	210
67. Camel hauling Volcanic Cinders in Saddle-box	211
68. Puerto de Arrecife	211

MADEIRA

69. Ponta de S. Lourenço	226
70. Grande Curral	226
71. Ribeiro Frio	227
72. Irrigation Canal (<i>levada</i>)	227
73. Porto da Cruz from the south	230
74. Madalena do Mar	230
75. Paul do Mar	231
76. S. Antonio da Serra	231
77. Câmara de Lobos	234
78. Porto da Cruz	234
79. Wickerwork Industry	235
80. Scabbard Fish	235
81. Funchal from the west	242
82. Funchal from the east	242
83. Machico	243
84. The Mount Railway, Funchal	243

PORTO SANTO

85. Porto Santo from Baixo	258
86. Vila Baleira from the north-east	258
87. Porto Santo from the east	259
88. Vila Baleira	259

DESERTAS AND SELVAGENS

89. Deserta Grande from Chão	260
90. Selvagem Grande from the south-west	260
91. Portuguese Cargo Vessel (S.S. <i>Butio</i>) lying off Selvagem Grande	261
92. Enseada das Cagarras, Selvagem Grande	261

S. MARIA

93. The Bay of S. Lourenço	270
94. Coastal Platform near Vila do Porto	270

facing

S. MIGUEL

95. Caldeira das Sete Cidades	278
96. Terraced Cliffs, south-eastern S. Miguel	278
97. Coast of Vila Franca Island	279
98. Lagoa from the east	279
99. Stacks of Maize Cobs	286
100. Glass-houses for Pine-apples, Ponta Delgada	286
101. Tea Plantation	287
102. Stripping a Whale at Capellas	287
103. Povoação from the east	290
104. Porto Formosa	290
105. Ponta Delgada from the east	291
106. Ginetes	291

TERCEIRA

107. Caldeira de S. Barbara	302
108. Monte Brazil	303
109. Coast of Terceira near Ponta da Mina	303
110. Houses in upper part of Angra do Heroismo	306
111. Bay of Praia from the west	306
112. Bay of Praia and Praia da Victoria	307
113. Angra do Heroismo from the sea	310
114. Angra do Heroismo from Monte Brazil	310
115. Angra do Heroismo and Monte Brazil	311

GRACIOSA

116. Caldeira of Graciosa from the south-east	312
117. Caldeira of Graciosa	312
118. Caldeira of Graciosa	313
119. North-western part of Graciosa, showing Victoria	314
120. North-eastern part of Graciosa, showing Santa Cruz	315

S. JORGE

121. South coast of S. Jorge near Morro Grande	316
122. Vellas	316
123. North coast of S. Jorge with Ponta Norte Grande and Pico da Esperanza	317
124. Vellas and Morro Grande	318

PICO

125. O. Pico	319
126. Lagens	319

facing

FAYAL

127.	South-eastern slopes of Pico Gorda with Island of Pico	.	.	326
128.	Pico do Fogo	.	.	326
129.	Caldeira of Fayal	.	.	327
130.	Road bordered by Hydrangeas	.	.	<i>Between pages 328 and 329</i>
131.	Road near Ribeirinha	.	.	
132.	Ponta do Castelo Branco	.	.	
133.	Bay of Praia do Norte	.	.	
134.	Flamengos from the east	.	.	
135.	Flamengos from the west	.	.	
136.	Porto Pim with Monte da Guia	.	.	
137.	Windmills on Fayal	.	.	
138.	Horta and Monte da Guia	.	.	330
139.	Horta from the north	.	.	331
140.	Horta from the south	.	.	331

FLORES

141.	Pico da Se	.	.	336
142.	S. Cruz	.	.	336

CORVO

143.	Corvo from the south	.	.	337
144.	Rosario	.	.	337

PART I
GENERAL DESCRIPTION

CHAPTER I

INTRODUCTION

THIS volume describes three groups of islands which lie in the Atlantic Ocean and belong to Spain and Portugal. The Canaries form an integral part of Spain, while Madeira and the Azores are known as the 'adjacent islands' of Portugal and are regarded as administrative parts of the mainland. The three archipelagos were



FIG. 1. *The Atlantic Islands*

excluded from the previous volumes on Spain and Portugal as it was considered best to combine the geographical accounts of these outlying provinces of the Iberian Peninsula into a separate volume. The Cape Verde Islands, Fernando Po, Principe, and S. Thomé have not been included because they are colonies and not administrative parts of metropolitan Spain and Portugal (Fig. 1).

Position

The Canaries. The Canary archipelago consists of a group of Spanish islands, south-west of Morocco, situated between $27^{\circ} 37'$

and $29^{\circ} 24'$ north latitude and $18^{\circ} 10'$ and $13^{\circ} 25'$ west longitude. They are separated from the continental mainland of Africa by a minimum distance of 67 miles, this being the measurement between the south-eastern extremity of the island of Fuerteventura and Cape Juby on the coast of Africa. The width of the group from east to west is 286 miles and their total combined area is about 3,100 square miles. There are seven main islands, Tenerife, Gran Canaria, Hierro, Gomera, La Palma, Fuerteventura, and Lanzarote. In addition to these there are numerous small islets (Fig. 2).



FIG. 2. *The Canaries*

Madeira. The Portuguese island of Madeira lies between $32^{\circ} 27'$ and $32^{\circ} 49'$ north latitude and $16^{\circ} 39'$ and $17^{\circ} 16'$ west longitude, about 575 miles south-west of Lisbon, and about 300 miles north-east of the Canaries. With it are included the other islands of the group, Porto Santo, 23 nautical miles to the north-east, and the Desertas, 10 nautical miles to the south-east (Fig. 3). The Selvagens, three rocky islets between Madeira and the Canaries, belong politically to the Madeira group. The area of Madeira is 285 square miles. The island got its name from the thick forests (*madeira* = timber) with which it was clothed when rediscovered by the Portuguese.

The Azores (Portuguese, *Açores*) are a widely scattered archipelago of nine Portuguese islands, situated towards the middle of the north Atlantic about 800 miles from the coast of Portugal and 1,200 miles south-east of Newfoundland. They lie between $36^{\circ} 59'$ and $39^{\circ} 44'$

FIG. 3. *The Madeira Group*FIG. 4. *The Azores*

north latitude and 24° 41' and 31° 16' west longitude, and their total area is 888 square miles. The archipelago, which owes its name to the numerous 'hawks' (*açores*) seen by the first discoverers, consists of three groups. Nearest to Europe lie S. Maria and S. Miguel (the largest island), while the central group is 100 miles away to the north-west, its five islands (Terceira, Graciosa, S. Jorge, Pico, and Fayal) being strung along a distance of another 100 miles. Finally, 125 miles farther north-west are the outlying islands of Flores and Corvo (Fig. 4).

Area and Population

The table below gives the area and population of each of the three groups of islands.

	<i>Area in square miles</i>	<i>Population</i>	<i>Density per square mile</i>
Canaries	3,100	566,599 (1930)	183
Madeira	314	249,138 (1940)	793
Azores	888	286,969 (1940)	323

There are eighteen principal islands, and the three groups as a whole have a total area of over 4,000 square miles, that is about the same size as the counties of Devonshire and Cornwall combined, or about half the size of Wales. The total population of the islands exceeds one million persons, with an average density of about 256 persons per square mile. It should be noted that the Spanish group of the Canaries is more than twice the size of all the Portuguese islands combined, but its density of population is considerably less than those of Madeira and the Azores. The number of persons per square mile on Madeira is about the same as that in England and Wales and is high for an island of such limited economic resources. The density of population of Spain (including the Canaries) is 120, while that of Portugal without the adjacent islands is 209.

Relief, Climate, and Vegetation

The islands are volcanic in origin and several of them contain peaks of considerable height. In Madeira one peak exceeds 6,000 feet, while in the Canaries the famous Peak of Tenerife is more than 12,000 feet in altitude. The Azores also are rugged and mountainous, the highest point being O Pico, over 7,600 feet, on the island of that name. It is difficult to make general statements about the climate of the three groups. In Madeira and the Canaries the climate is equable,

warm in winter and seldom excessively hot in summer. In the Azores the climate is temperate but humid, and storms are frequent. The islands show differences in the character of their vegetation: Madeira is covered with rich sub-tropical vegetation, while some parts of the Canaries bear almost a desert aspect. Each group has its own peculiarities of climate and vegetation which will be fully described in the following chapters.

Economic Resources

Apart from tourist traffic and port activities the chief industry of the islands is the production of fruit and vegetables. These are supplied to ships and are also exported in considerable quantities. In the Canaries bananas and tomatoes are of first importance, followed by early potatoes and onions. In Madeira the vine is the most important crop and wine is a leading export. Many other fruits are grown, including pine-apples and bananas for export. Sugar, formerly the leading staple crop, is now of minor significance. Early vegetables including potatoes are also exported. The Azores produce wheat, maize, beans, vines, sugar-beet, and tobacco for local needs, and some wine, butter and cheese are exported to Lisbon. Pine-apples are grown for the London market.

Ports

The chief port in the Canaries is Santa Cruz de Tenerife with 62,000 inhabitants, while Las Palmas on Gran Canaria has 70,000. In Madeira the port of Funchal with 68,000 inhabitants is the only large town. In the Azores the towns are much smaller. Ponta Delgada on S. Miguel, a town of 18,000 persons, is the chief port, while Angra do Heroismo with 11,000 inhabitants is the seaport of Terceira. The chief town of Fayal is Horta with a good natural harbour.

Relations with Great Britain

It was natural that these Atlantic islands should have come into the hands of the Spanish and Portuguese as the Iberian peoples were the leaders in the great age of exploration in the fifteenth and sixteenth centuries. The islands formed useful stepping-stones for the routes round Africa to India and also for that to the Americas. It was also natural that Elizabethan sea captains were concerned with the islands. Drake and Hawkins were beaten off when they attacked the Canaries. The epic fight of Sir Richard Grenville in the *Revenge* against a Spanish fleet of fifty-three ships took place in 1591 off

Flores, the most westerly of the Azores. Sir Walter Raleigh once seized Fayal. Two hundred years later, in 1797, Nelson lost his right arm at Santa Cruz de Tenerife. Madeira was occupied by British forces in 1800–1802 and again between 1807 and 1811.

In 1813 Captain Thomas Aske wrote a *History of the Azores* 'demonstrating the importance of these valuable islands to the British Empire'. He argued that the Western Islands should be placed under the immediate protection of Britain, but no attempt was made to occupy or annex them during the Napoleonic wars. However, in October 1943 the Portuguese, by virtue of the ancient alliance between Britain and Portugal, granted facilities in the Azores to Britain to enable better protection to be provided for merchant shipping in the Atlantic. The United States, who towards the close of the War of 1914–1918 had a naval base at Ponta Delgada, were permitted to share the use of these bases in the Azores with Britain. Of the Anglo-Portuguese alliance Canning said in 1826 that no alliance was 'so ancient in origin, and so precise in obligation—none has continued so long and been observed so faithfully—of none is the memory so intimately interwoven with the most brilliant records of our triumphs'. In October 1943 Mr. Winston Churchill, speaking about the Azores agreement in the House of Commons, said that it 'should give new life and vigour to the alliance which has so long existed between the United Kingdom and Portugal to their mutual advantage. It not only confirms and strengthens the political guarantees resulting from the treaties of alliance, but also affords a new proof of Anglo-Portuguese friendship and provides an additional guarantee for the development of this friendship in the future.' Time only emphasizes the permanent common interest of two trading and colonizing Powers in the freedom of the seas.

Strategic Position

Each of the three groups of islands holds a strategic position in the system of world routes. Madeira and the Canaries are well known to those who travel from Europe round Africa to the east, while the Azores are near the main trade route of the north Atlantic and in fact hold what may be considered a central position for all transatlantic routes. The importance of the Azores as an intermediate base for trans-oceanic flight is well known; the transatlantic Clippers call regularly, except in winter, at Horta on Fayal. The Azores also look southward and contribute to the safety of shipping and travelling between Europe and South America.

Thus these small Atlantic islands, each with its own peculiar characteristics, each possessed of a certain remoteness from the greater world of the continental land-masses, are nevertheless placed at strategic points in the crossing of the oceans by sea or air. They have a far higher significance than is warranted by size alone. This importance was even greater in the days of sailing-ships, and it is worth recalling that Columbus on his first voyage across the Atlantic in 1492 sailed westward from the Canaries with the trade-winds behind him and reached the Azores on his return journey in the following year with the help of the westerlies.

Arrangement of Volume

The arrangement of this volume necessarily differs in several respects from that adopted for the rest of the series. Spain and Portugal have already been described in the three previous volumes, and as the Atlantic islands form integral parts of these states there is no need to repeat some subjects such as currency, finance, and postal services, which with few exceptions are performed in the same way as on the mainland. Many of the observations made in the introductory chapters of the previous volumes can be applied with equal truth to the islands.

As this volume is an account of eighteen main islands and numerous small islets the general layout adopted for the series had to be modified. The six chapters which follow the introduction are of a general nature. In these chapters treatment is by groups of islands. A general physical and geological description (Chap. II) is followed by accounts of climate (Chap. III), of flora and fauna (Chap. IV), of history (Chap. V), of administration and public health (Chap. VI), of the peoples (Chap. VII), of commerce (Chap. VIII), and of signal communications (Chap. IX).

In the remaining three chapters (Chapters X–XII), each of which is devoted to one of the island groups, a brief general review of the group is followed by a detailed description of the individual islands. An attempt is made to present a comprehensive geographical picture of each island. As far as possible the islands are considered in the same way, the information being arranged under the same headings or in the same order. As a general rule an account of the relief, drainage, vegetation, and coasts of each island is followed by a description of its distribution of population, industries, ports, and communications.

CHAPTER II

GENERAL PHYSICAL AND GEOLOGICAL DESCRIPTION

THE three groups, the Canaries, Madeira, and the Azores, are truly oceanic, yet their position with regard to the main relief features of the north Atlantic basin shows notable differences. The Azores belong structurally to the great central rise of the Atlantic Ocean and lie nearly midway between north-west Africa and Newfoundland; the Canaries and Madeira arise from deep-seated submarine plateaux that project, as it were, from the base of the nearest land-mass. It happens, however, that the general position of these two latter groups differs considerably, since Madeira is 368 miles from the nearest point of the African mainland, whereas Fuerteventura in the eastern Canaries is only 67 miles from the African coast at Cape Juby. Hence, although the multifarious influences of an oceanic position dominate the geography of all three island-groups, they are strongest in the Azores and weakest in the Canaries.

Each of the archipelagos is closely surrounded by deep water, the sea-floor even between Fuerteventura and Cape Juby descending to nearly 4,500 feet. The Azores, Madeira, and the western Canaries rise steeply from depths of over 10,000 feet, while the ocean bed between the main groups of islands is several thousand feet deeper. The great depth between many of the individual islands of the same group is even more remarkable. In the Azores, the sea-floor between S. Miguel and S. Maria (53 miles) sinks to 8,500 feet, while that between Terceira and Graciosa (45 miles), and between Terceira and S. Miguel (98 miles), descends to 7,900 feet and 11,500 feet respectively. These great intervening depths clearly illustrate the fact that nearly all the individual islands are distinct entities, and, as such, have been built up from the ocean floor (Fig. 5).

FORMATION

The islands, except S. Maria in the Azores, are merely cones of ejection, having been formed by volcanic activity during and subsequent to the Tertiary Age. The present exposed surfaces are the summits of larger and probably in some cases of older volcanic cones. The eruptions responsible for raising and maintaining the groups above sea-level have alternated with long periods of quiescence when

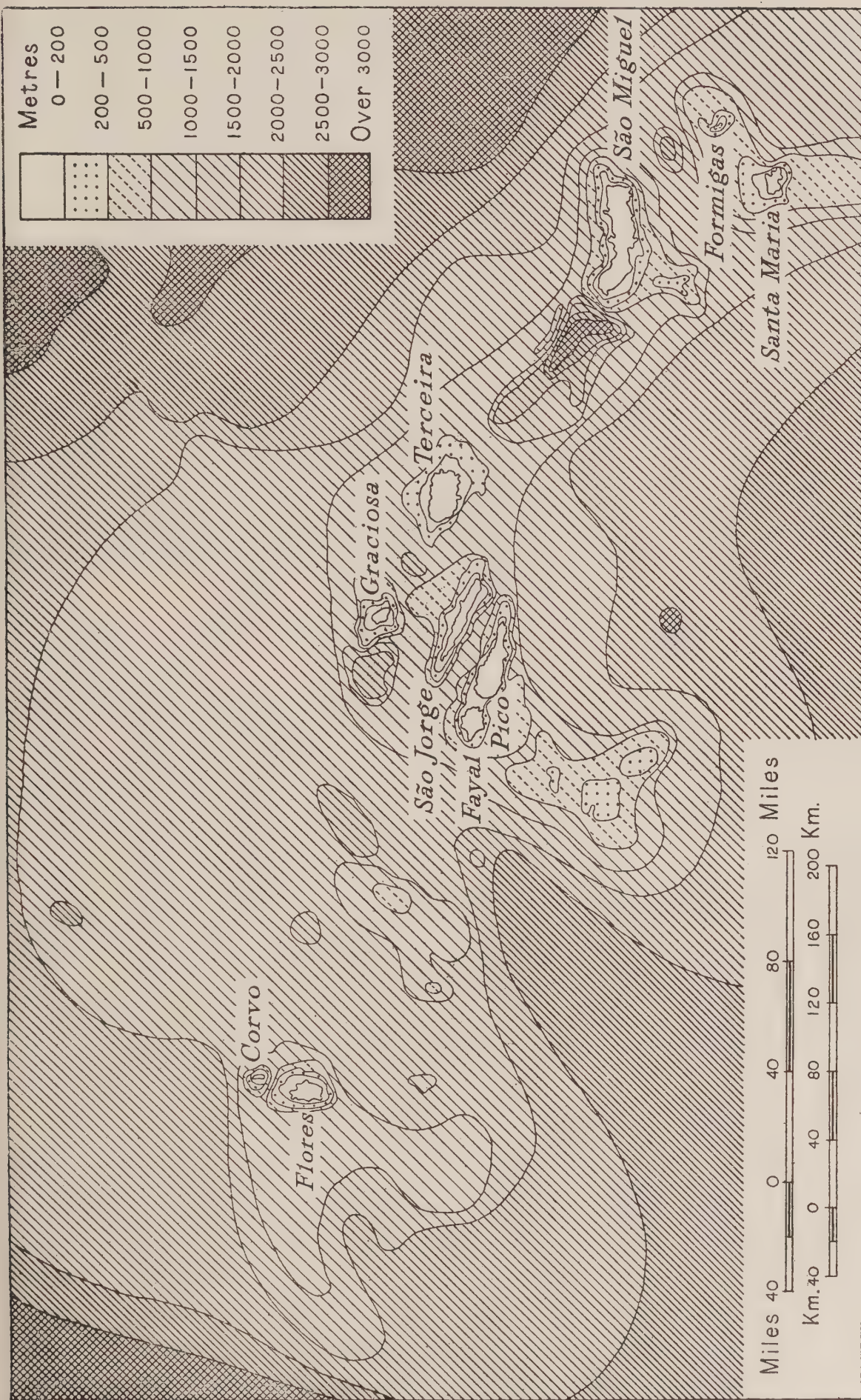


FIG. 5. *The Ocean Depths off the Azores*

normal surface denudation was active, but this erosion has seldom proceeded far enough to expose the older volcanic bases, if any, of the islands. In the Canaries exposures of old basement rocks are found on Fuerteventura, Gomera, and La Palma, where they appear as coarse, crystalline plutonic outcrops (syenite, diorite, &c.) and as much metamorphosed volcanic rocks, the latter in Fuerteventura being associated with altered slates and limestones. It is probably on

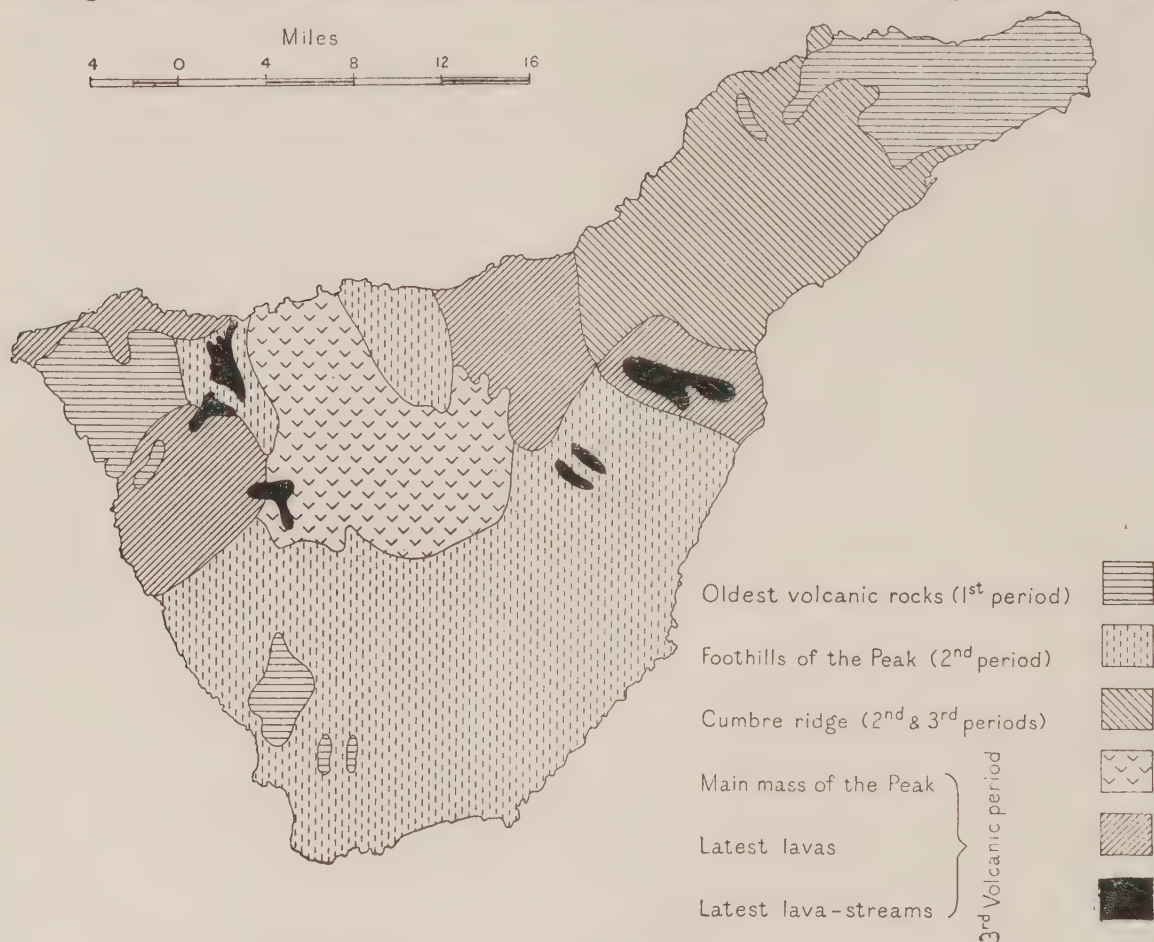


FIG. 6. *The Geological Structure of Tenerife*

older volcanic bases such as these that many of the present islands have been built, lavas of Tertiary and Quaternary Age naturally forming the bulk of the visible rocks.

The recent geological history of Tenerife may be assumed to be typical at least of that of the larger islands. Here three main types or periods of lava-flow can be distinguished. The oldest surface, traceable in the Teno and Anaga peninsulas and in the neighbourhood of Adeje, has been almost unaffected by subsequent disturbances and has been eroded by rainwash into highly serrated land-forms. The remainder of Tenerife was covered by great lava-flows which are furrowed to-day by the deep chasms of the barrancos. These

lavas were later hidden over large areas by further flows, which, however, have been partly denuded away except where thick, as near the points of outflow, or where preserved by down-faulting as in the vales of Orotava and Güimar. It is noticeable that the ravines cut by flowing water into the most recent lavas have not yet reached any considerable depth in contrast with the huge barrancos furrowing the outbursts of the second stage (Fig. 6).

A subsidiary factor operating during the formation of the islands was the succession of changes in the relative level of the sea. Quite apart from any alterations of sea-level during the Ice Age, the volcanic nature of the islands tends to cause instability, especially elevation of the land. The presence of marine deposits in some localities and the occurrence of what appear to be coastal platforms in others denote a relative elevation of the island-mass; the former is of great local economic importance, while the latter forms the only sizeable plains in several of the islands.

NATURE AND STRUCTURE OF THE ROCKS

Igneous

The volcanic or igneous rocks of which the Atlantic islands are almost entirely composed consist of two main types, the lavas, and the less resistant fragmental matter such as tuffs, ash, and scoriae. There is a tendency for basalt to predominate in the older lava-flows and trachyte in the newer, but the composition of either is far from consistent. In the valley of Orotava the streams of lava derived from the Cumbre are largely composed of andesite, a rock-intermediate between the highly basic (or viscous) and highly acid (or fluid) types of lava. In Tenerife the walls of the Cañadas are of basalt, while the Peak and its subsidiary cones consist of trachyte, pumice, obsidian, and ashes. Since molten basalt lava is only of average fluidity, it tends to build relatively steep, high cones such as are seen in Tenerife, La Palma, and Pico.

The fragmental matter thrown out by volcanic eruptions is usually more widespread than the lava-flows and is generally arranged with the coarser debris nearest to the source of activity. This type of detritus commonly forms the bulk of new cones and of subsidiary craters that break out on the lower flanks of the main volcanic mass. The loose fragments may pile up near the vent, accumulating in slopes of 30° and even 40° . This type of matter seems to have been especially abundant in recent eruptions in the Azores, where, for example, in 1630 parts of S. Miguel island were buried under 5 to

17 feet of volcanic dust. This smaller matter is usually friable and in a damp climate soon becomes clothed with vegetation; it varies considerably in compactness and hardness, and may occasionally form a hard pan at its base.

Since the normal volcanic eruption emits lava and fragmental debris, sections of sea-cliffs and of barranco sides in the Atlantic islands invariably reveal a superimposed succession of lava and of tuff or other detritus. Locally, the latter have been metamorphosed by heat throughout their entire thickness, and are often, especially near the vents and fissures, interlaced by numerous dikes or intruded veins of igneous rock.

The effect of these rocks upon water-supply is of great importance, especially in the more arid Canaries, since the succession of porous and almost impervious layers often creates a number of water-tables, some of which hang above the level of the valley-floors. The varying dip of the rocks, especially near the craters, leads to much imprisonment of underground aquifers, which in parts are tapped by the inhabitants by means of elaborate tunnels. The porosity of the cinder and ash cones makes them devoid of surface water, but supplies often accumulate at the junction of the cone and the more impervious lavas beneath it.

The volcanic nature of the rocks makes it highly improbable that minerals other than sulphur will be found in any quantity. The specular iron, iron pyrites, and globules of copper recorded in Madeira and the Canaries are absolutely insignificant, and even the sulphur deposits of Tenerife are very small. Consequently, by far the most valuable underground products derived from vulcanism are the mineral and thermal springs.

Sedimentary

In the Canaries the only sedimentary rocks associated with the lavas are stratified tuffs and conglomerates containing a marine fauna of upper Miocene Age. These rocks are particularly well developed as a coastal terrace near Las Palmas, where they are intercalated with trachytic lavas.

The only other sedimentary deposits in all the islands, apart from the much altered slates and limestones of the basal complex of Fuerteventura, are a few limited calcareous beds of the Miocene period. S. Maria in the Azores consists mainly of calcareous deposits about 20 feet thick; in the Madeira group there are marine, fossiliferous limestone beds on the islet of Baixo, at 200 feet above sea-

level, and in the valley of S. Vicente at 1,300 feet altitude on the main island; similar deposits occur at about 260 feet near Jinamar in Gran Canaria. The most extensive calcareous deposits are, however, at no great height above sea-level in Fuerteventura, where, it is thought, they may be partly due to the decomposition of basaltic rocks, a supposition which may also be true of some of the limestone pockets elsewhere. Since these various calcareous beds are the only local source of lime, they are actively quarried and form an important item of inter-insular trade.

Fossils are found in localities outside the limestone beds discussed above. They abound, for example, in the calcareous sands of the S. Lourenço peninsula and, as brown coal and plant remains, in the Ribeira de S. Jorge on the north coast of Madeira. Land-snails occur in some of the volcanic conglomerates—but the most remarkable find of recent years was the fossilized remains of a giant tortoise (about 32 in. by 20 in.) unearthed at 690 feet above sea-level near Adeje in Tenerife.

Blown Sand

Many of the small beaches of the Atlantic islands consist of black sand, produced mainly by wave-action from basalt and other volcanic rocks. Some of the islands, and especially Madeira, Porto Santo, and the Canaries, have more extensive stretches of sand which is yellow or whitish in colour and is composed of triturated sea-shells, limestone, and minute fragments of volcanic rocks. This lighter-coloured sand is also of local origin and is distinguished from normal desert sand by its lack of quartz. For the most part, it forms on the shore and is blown inland by the wind often as moving dunes. Sand-covered surfaces are most extensive in the more arid islands of the Canaries and in flat coastal areas elsewhere that face the prevailing winds. Notable stretches of dune—usually formed from marly limestones—occur near Confital bay and Alcaraveras in Gran Canaria, at the isthmus of Las Matas Blancas in southern Fuerteventura and at the southern extremity of Lanzarote (Photo. 1).

CHARACTERISTIC LANDFORMS

Volcanic Accumulation

The three archipelagos have long formed a classic ground of volcanic studies for European geographers since they exhibit the various landforms typical of localized eruptions on a remarkable

range of scales and perfection. Only the extensive lava-plateau associated with upwellings from large fissures is absent, which is not surprising as the islands, although probably arising from a common line of weakness, are essentially the products of individual points of eruption. The characteristic landforms are the conical peak, the circular cup or crater, and the individual lava-stream of recent times.

Conical Peaks. The grandest volcanic cone in the Atlantic islands is the Peak of Tenerife (*Pico de Teide*) which rises to 12,162 feet from the large imperfect crater of Las Cañadas. The uppermost 1,000 feet, above a more recent, obliterated crater at Rambleta (11,700 ft.), forms the Pílon or Sugar Loaf which slopes at an angle of 33° to 38° . The little crater at the top of the Pílon is only 80 feet deep and 150 feet in diameter. The main flanks of the peak below Las Cañadas retain a conical shape in spite of the complicated nature of their formation.

The cone of Pico (7,615 ft.), the culminating point of the Azores, rises more abruptly from the sea than does the Peak of Tenerife, the slopes on the north and east exceeding 40° . The principal cone terminates in a crater about 200 feet deep, from the centre of which a secondary cone, very perfect in shape and composed of scoriae and lava, rises over 200 feet above the crater rim (Photo. 2).

This conical nature is only retained by volcanoes that have been recently active; where the eruptive force has long been quiescent the peak of the cone is flattened by weathering and erosion, and assumes the shape of an inverted bowl, as is well seen in Gran Canaria and Gomera.

The summit of the main peaks and the whole mass of many of the small subsidiary cones are often composed mainly of cinders which will occasionally accumulate in very steep slopes. Rounded heaps of cinders, or *fumaroles*, are common throughout the islands, and are of various colours and consistencies. Those composed of black ash and scoriae, such as Montañeta above the Grand Hotel, Orotava, seem most resistant to weathering; those of a lighter colour disintegrate fairly quickly but keep their rounded form to the last, as happens in the fumaroles between La Laguna and Tacoronte; others of a compact, earthy nature weather to a peak, as in the Pico de Gáldar in Gran Canaria.

Craters. The Peak of Tenerife, with its major and minor craters, is a composite cone of great complexity. Frequently, however, a volcano consists solely of the cup and containing walls of a crater,



1. *Sand dunes in Puerto de la Luz, Gran Canaria*



2. *The island of Pico seen from Fayal*



3. *The Caldeira of Fayal from the north-east*



4. *Caldera de Bandama, Gran Canaria*

whence the use of the Spanish *caldera* (Port. *caldeira*) as a generic term for all volcanoes except the *picos* (Photo. 3).

The largest crater in the Atlantic islands is the Gran Caldera de Tabouriente in La Palma, the south-western rim of which has been breached by erosion. The great crater of Las Cañadas in Tenerife has been filled on the north and west by more recent lava-flows, but on the south-east is still a formidable depression nearly 10 miles long and 2 miles or so wide. In the Azores the most perfect crater is that nearly 1 mile in diameter on Fayal; among other examples are the Caldeira de S. Bárbara in Terceira and the crater forming Corvo island.

It is not unusual for the craters to have broken down on one side either by lava-flows or by erosion, but a great many intact cups remain, one of the most notable being the Grand Caldera near Tafira in Gran Canaria. In the Canaries the perfect craters are only associated with minor volcanoes, whereas in the Azores most of the main craters have a continuous rim (Photos. 4 and 5).

The steep inner walls of the crater cup have a most important effect on water-supply and on communications. Rains falling on the peak or on the inner side of the high enclosing rim percolate to the crater floor, whence they break forth as springs. Thus Las Cañadas is almost waterless except for the springs at the foot of the precipitous crater walls, while springs at a similar position in the Gran Caldera de Tabouriente feed several barrancos and supply water to the adjacent seaboard areas. In Madeira and the Azores the cup of the crater usually contains a seasonal or a permanent lake, some of which, as at Furnas, Sete Cidades, and Fogo in S. Miguel, are quite large. The lake at Fogo is $1\frac{1}{2}$ miles across.

The minor craters are easily avoided by routes, but the main craters, or those around which some islands have been built, offer great obstacles, as their precipitous inner walls are often practically insurmountable. Roads approach or circumvent the outer edge, but the floor of the cup is reached only on foot as, for example, at Sete Cidades in S. Miguel, and at the crater of Fayal and the Caldeira de S. Bárbara in Terceira. The floor of the imperfect crater at Furnas, S. Miguel, is only about 700 feet above sea-level, but the motor-road to it is steep and winding; access to Las Cañadas is virtually restricted to a few passes through the crater walls, while the great cup of La Palma is reached by road only through the breach in its south-western rim. The relative inaccessibility of the crater cups has caused many of them to be used in the past as refuges and strongholds against invaders.

Semicircular bays, resulting from the partial submergence of craters, are not uncommon in the Azores and the Canaries. The most notable are the Caldeira do Inferno, just south of Horta in Fayal, and Vila Franca islet south of Vila Franca do Campo in S. Miguel. Many of these partly enclosed harbours are suitable for small craft.

Recent Lava-flows. Individual lava-flows, although physically an insignificant component of the island-mass, often form a very distinctive feature of the landscape. This is especially so in the Canaries, where, for example, recent flows often occur at Arafo, Güimar, and Garachico in Tenerife, on the west of Yaiza in Lanzarote, and on the south-west of La Palma. These streams are usually almost bare and waterless and their sharp, rugged surfaces are difficult to cross (Photo. 6). The lava-stream which destroyed Garachico in 1706 is a succession of ravines where the hot lava in the centre ploughed great furrows in the semi-cooled mass that preceded it. After more than two centuries this lava is only just beginning to decompose, whereas the more recent outbursts of ash and tuffs on the wetter islands of Madeira and the Azores have broken down relatively quickly and are covered with vegetation.

The lava-flows, owing probably to the continued movement of the interior after the solidification of the exterior, occasionally contain caves. That below Icod de los Vinos in Tenerife was used as a burial ground by the Guanches; the Cueva de los Verdes below Haría in Lanzarote—a cave over 2,000 yards long and in parts 200 feet high—was used as a retreat in time of invasion. Both of these caves have an entrance near the sea. Other caves occur, for example in the valley of S. Vicente, Madeira, and in the caldeira at Graciosa in the Azores, where the *Furna do Enxofre* is of enormous dimensions.

Surface Erosion and Weathering

The steep slopes of many of the Atlantic islands, the intermittent, torrential nature of the rains, the alternation of hard lavas and relatively soft tuffs, and the aridity of much of the lower areas, all favour the formation of abrupt-sided valleys. The typical valley is a gorge with sides rising almost precipitously for several hundreds of feet and, in some instances, for several thousands. The valley-floor is usually waterless for long periods, the stream course being marked by a wide ribbon of pebbles and boulders. In the Canaries the barranco sides are mainly barren and rise from a belt of debris



5. *Caldeira, Corvo*



6. *Recent lava-flow in Gran Canaria*



7. *Ribeira Brava, Madeira, from the sea*



8. *Ribeira Brava valley from the north*

or scree; in the Azores and Madeira the damper climate forms less precipitous slopes and encourages a luxuriant vegetation. Among the larger valleys of the islands are the Grande Curral and the Serra de Agua in Madeira, the barranco de las Angustias in La Palma and the barranco de la Aldea de S. Nicolás in Gran Canaria (Photos. 7 and 8).

These gorge-like valleys, especially when close-spaced, are such formidable obstacles to communications that roads either follow the valley-floor, entering at its head and leaving at its mouth, or avoid the gorge sections by keeping to the coast where the barrancos open out into wide shallow expanses of sand and pebbles. Thus, the circum-island nature of the communications is largely a result of the deep ravines that furrow the volcanic slopes.

Apart from running water, the other agents of denudation in these islands are the wind, which forms the sands and dunes described above, and weathering. The soil produced is generally shallow except where the most recent eruptions have consisted of friable matter, in which areas the surface deposits may range from a few feet to many yards in depth. There is frequently not enough soil to hold a tent-peg, and even in the deeper soils of the damper islands the underlying rock is generally compressed into a pan hard enough to withstand the blows of any but a sharp, heavy pick.

Marine Erosion

The force of the waves on the coasts of the Atlantic islands is unusually great, since the winds have a long fetch and the narrow foreshores allow the breakers to hurl themselves almost unimpeded against the shore. As the prevailing winds and strongest waves approach from the north, north-east, and north-west, it is these coasts of the islands that are usually most cliffed. Moreover, the oceanic position almost ensures wave-action at all times, and often when the weather is calm locally the breakers roll in from the Atlantic with great power.

The resistant volcanic lavas composing so much of the coastline sometimes stand in cliffs several hundred feet high; they do not readily break down into boulders and much less readily disintegrate into sand and smaller rubble that would accumulate as beaches. Thus the characteristic coast is precipitous and fringed with boulders or reefs of black basalt. Only where promontories form sheltered areas do sand and pebble accumulate, such accumulations being most common on the east and south coasts, and on the southern side of local projections. The volcanic sand is usually black in colour,

but yellow and whitish sands are not uncommon (p. 15). Where streams or dikes of lava enter the sea in close proximity to each other, their cliffed headlands form natural breakwaters that often shelter small harbours which can be used as landing-places by small boats, as happens near Tacoronte in Tenerife and on the south coast of Alegranza island (Photos. 9 and 10).

The destructive action of the sea has hollowed out numerous caves in the cliffs and has also, by causing retreat of the cliff-face, exposed others of volcanic origin in lava-flows (p. 18). In some parts, as at the landing-place of La Peña, Fuerteventura, the caves are to-day a few feet above sea-level. Generally speaking, caves are most numerous in the Azores, one of the largest being near Horta, but they are common enough in the other island groups. Those south of Tejeda near the Roque de Bentaguaya were the last stronghold of the Canarios in their struggle with the Spaniards; those in the lava-cliffs near Tacoronte were inhabited by the Guanches; others at Graciosa (Canaries) and Montaña Clara are the haunts of colonies of sea-birds. This abundance of caves—of marine, volcanic, and artificial origin—is reflected in the large part they played in the customs and lives of the early settlers of the islands.

The peaked and crater-like shape, the small size and the steep slopes of most of the Atlantic islands practically exclude the formation of alluvial lowlands. Yet there are, in parts of the islands, flat areas near the coast, which presumably have been levelled under the sea and subsequently elevated above sea-level. The coastal platforms near Buenavista in Tenerife, near Mosteiros in S. Miguel, in the southern part of Lanzarote, and in south-eastern Gran Canaria have a flatness apparently attributable to this cause. The level surface of these areas contrasts markedly with the steeply sloping floors of the vales of Orotava and Güimar which seem to have been formed by faulting (p. 13). The coastal platforms are the only extensive plains in the islands, but even so their actual surface is often stony and boulder-strewn and not infrequently terminates seawards in high cliffs (Photo. 12).

RECENT VOLCANIC AND SEISMIC ACTIVITY

The Canaries

During the last 450 years the islands of Tenerife, La Palma, and Lanzarote have shown considerable volcanic activity while the other main islands of the group have remained quiescent and have not

even been affected by serious seismic disturbances. The chief eruptions of recent times are given in the following list.

- 1430 Tenerife; built Monte Taoro.
- 1444, 1455, 1484 Eruptions on Tenerife.
- 1492 Tenerife; recorded by Columbus.
- 1585 La Palma; near Lavanda at 2,600 feet above sea-level; the lava flowed down to the sea and killed fish for 3 miles around.
- 1604 Tenerife; small eruption near Siete Fuentes.
- 1605 Tenerife; small eruption near Fasnía.
- 1646 La Palma; violent, near Tigalate.
- 1677 La Palma; extremely violent; accompanied with a terrific noise and enormous upwelling of lava that destroyed the warm baths at Fuencaliente.
- 1705 Tenerife; near Güimar; moderate.
- 1706 Tenerife; violent but local; lava-stream overwhelmed Garachico.
- 1730–1736 Lanzarote; almost continuous eruptions in western parts, ravaged nearly one-third of island; violent in 1735; submarine eruption close to island in June, 1730.
- 1796 Tenerife; north-west of Peak; moderate.
- 1798 Tenerife; north-west of Peak; moderate flow from M. de Chahorra at 6,000 feet above sea-level.
- 1824 Lanzarote, north-west of Puerto de Naos; insignificant.
- 1909 Tenerife; minor eruption near M. de Chinyero, an extinct blow-hole not far from volcanoes of 1705 and 1796–1798.

During this, the last notable eruption in the Canaries, a crater opened on a flat cindery expanse, and its formation was accompanied with sharp, loud detonations, audible at Orotava, 16 miles away. The activity continued for 9 days and the craters increased to four. Stones were thrown to over 2,000 feet, but nothing palpable was carried more than a few miles, and a gentle south-easterly wind piled up most of the ashes, cinders, and dust in a bank about 500 feet high on the north-western side of the blow-holes. A stream of hard, brittle, black lava moved westwards towards Santiago del Teide at an average speed of 30 to 40 yards an hour—the country here being flat—and extended in all about 3 miles with an extreme width of half a mile. Soon after bifurcating around Moñtana Bilma the flow stopped for lack of new material.

Visible signs of continued activity in the Canaries to-day occur at the summit of the Peak of Tenerife, where many blow-holes (2 to

3 inches across) of the little crater emit sulphurous vapour in some cases at 145° F.; and at the Montañas del Fuego in Lanzarote, where the heat in some of the blow-holes and crevices will kindle wood and boil water and has reached a temperature of 800° F. In 1933 there was considerable volcanic activity on the ocean floor near the coast of Tenerife.

Madeira

The various islands of the Madeira group have been undisturbed by eruptions in historical times and, where cinders and slag do occur at the surface, their sharp edges have usually been rounded and covered with vegetation. Yet several severe earthquake shocks have been recorded since the island's discovery, the most violent being those of 1748, 1755, 1816, and 1918. During the first, some damage was done to the cathedral and to churches in other parts of the archipelago. It is probable that the tremendous landslide which occurred on the west side of Deserta Grande in 1891 was due to a submarine volcanic or seismic disturbance, as there was a contemporaneous oscillation of sea-level at Madeira.

The Azores

All the main islands of the Azores, except S. Maria, Graciosa, Flores, and Corvo, have experienced severe eruptions in historical times. S. Maria, Graciosa, and Corvo are the only islands on which violent earthquakes have not been recorded. Consequently the superficial results of geologically recent seismic and volcanic activity are much more apparent here than in Madeira and the Canaries. Submarine tremors, too, are much more frequent and often damage cables.

About fifty violent spasms of earthquakes and/or eruptions have been recorded in the last 500 years and many of them lasted several months. Half of these occurred in or near S. Miguel, where the descent to the deep-sea floor is most precipitous. The above numbers do not include minor tremors and shocks, which are of yearly occurrence. Nor does the absence of eruptions within historical times on some of the smaller islands denote a lack of the scenic characteristics arising from vulcanism; Graciosa, for example, has extensive lava-flows and a large crater (*frontispiece*). The main eruptions and earthquakes recorded in and near the individual islands of the Azores since 1444 are given in Appendix A.

Evidence of continued volcanic activity, apart from earthquake



9. *Islets off Mosteiros, S. Miguel*



10. *Lava stream forming cliffs at Ponta do Misterio, Terceira*



11. *Hot springs at Furnas, S. Miguel*



12. *Coastal platform at Victoria, Graciosa (Azores)*

tremors, is found on at least four of the islands. The valley at Furnas in S. Miguel has a number of boiling springs and geysers, heated vapours, turbid water and grey mud being ejected; hot gas (165° F.) still issues from crevices in the little crater at the summit of Pico; fumaroles or blow-holes emitting steam occur on the west side of the volcanic tableland of Agualva in central Terceira, while a few crevices in the great cave near the crater floor in Graciosa emit carbon dioxide (Photo. 11).

CHAPTER III

CLIMATE

GENERAL FACTORS

Main Pressure and Wind Belts

THROUGHOUT most of the year the Azores, Madeira, and the Canaries lie either within or on the periphery of the main high pressure system of the North Atlantic Ocean. The Azores (lats. 37° N.– 39° N.) usually find themselves on the northern side of the 'high' and at its junction with the westerly wind system. Consequently in the winter half-year, when the low-pressure belt of the westerlies is felt farther southwards, the islands often come under the influence of depressions which move eastwards usually north but sometimes south of the group. These depressions are liable to occur during other seasons, being least common between May and August when the 'high' is most strongly developed.

Madeira and the Canaries are situated on the eastern fringe of the high pressures and on the northern edge of the north-east trade-wind belt. In the summer half-year this position ensures almost constant, dry north-east winds, but in winter the effect of eastward moving depressions is still strongly felt in Madeira (lats. 32° N.– 33° N.), where rainy, squally weather is then common. The same eastward-trending depressions cause most of the scanty rainfall of the Canaries (lats. 27° N.– 29° N.), which, however, lie so far south that the effect of cyclonic disturbances is much weaker and more infrequent than in Madeira. Seasonal differences are least marked in the Canaries, where the length of consecutive daylight ranges only from a minimum of 10 hours 11 minutes to a maximum of 13 hours 49 minutes.

Ocean Currents

The position of the three archipelagos with regard to wind systems is practically the same as that relative to the general circulation of the surface water of the North Atlantic Ocean. The Azores are on the southern edge of the warm North Atlantic Drift; Madeira is at the commencement of, and the Canaries within, the south-westward drift of the Canary current. These ocean currents are distinguished by means of their general direction and by their temperature relative to that of the adjacent water-masses. Thus the

surface water near the Azores is usually 3° F. to 5° F. warmer than the average of the ocean in these latitudes, while the sea near Madeira is about the same as, and that about the Canaries is between 2° F. and 4° F. colder than, the average warmth of the surface water in their latitudes. Statistics of the absolute or actual temperatures of the ocean near the three island groups tell a different story, as is shown in the following table.

Mean Monthly Temperatures ($^{\circ}$ F.) of Surface Water

	<i>February</i>	<i>May</i>	<i>August</i>	<i>November</i>
Azores	60	63	73	65
Madeira	63	65	74	69
Canaries { Western	65	68	73	71
{ Eastern	64	66	70	68

It will be seen that the temperature of the surface water decreases with latitude fairly regularly except in summer and except in the neighbourhood of the eastern Canaries. In summer the sea off the Azores is about as warm as that off the western Canaries some 600 miles to the south, the reason for the abnormal warmth, here and in Madeira, being proximity to the main mass of the North Atlantic Drift. The relative coolness of the sea all the year near the eastern Canaries is mainly due to the upwelling of cold water that occurs off the African coast between Tangier and Cape Verde. This upwelling largely explains why in summer the sea off Madeira is often 8° F. or so warmer than that near Mogador on the Moroccan coast, and why the eastern Canaries form the only part of the three archipelagos where the sea is always cooler than the air above it.

Continental Winds

The only notable continental influence on the climate of the three island groups is the hot, dry, dusty weather that often accompanies easterly and south-easterly winds. This influence is weakest in the Azores, where a little dust, very fine in size and almost devoid of quartz, may fall at long intervals. In Madeira during the summer half-year, and more especially between July and September, occasional dry easterly winds (*Este*) may carry sufficient dust to produce a haze which is often more pronounced in the upper layers than near the surface. In the Canaries, during all seasons of the year, dry easterly winds may bring dust from Africa that considerably diminishes

visibility and has been known on rare occasions to restrict the view to about 200 yards for more than forty-eight hours and to cover everything with a fine, white powder. The dust, which includes quartz, is not confined to the surface layers of the atmosphere but is likely to be found more in the easterly current, probably an extension of the west African *harmattan*, lying above the north-east trades. However, very little, if any, dust falls on the peak of Tenerife at heights above 9,000 feet.

Local Topographic Effects

The normal lowering of temperature with increase of altitude, at the average rate of about 3° F. per 1,000 feet, has an important effect in all three archipelagos, since five of the main islands exceed 6,000 feet and most of the others rise to over 3,000 feet above sea-level. In addition, the size and abrupt slopes of the mountains cause appreciable differences in the weather on their windward and leeward sides. Thus, in most of the islands and especially in Tenerife, the exposed northward-facing slopes experience more cloud and more rain than those facing south. The obstruction offered by the higher peaks to the prevailing winds is liable to form air eddies, there being, for example, an atmospheric indraught on the lee side of some islands which at times may reinforce sea breezes blowing on to the south coasts.

A few of the higher peaks rise well above the main cloud layer, as is seen at Pico in the Azores and at Pico de Teide in Tenerife, where trade-wind clouds usually form at 3,000 feet to 4,500 feet on the northern slopes and, as a thinner layer, at 4,500 feet to 5,000 feet on the southern side (Photo. 2). The latter peak is often above the upper limit of the north-easterly trades and a definite westerly current is common at heights exceeding 8,000 feet to 9,000 feet. Details of the topographic influence on the various climatic elements in the different groups are given in the following pages.

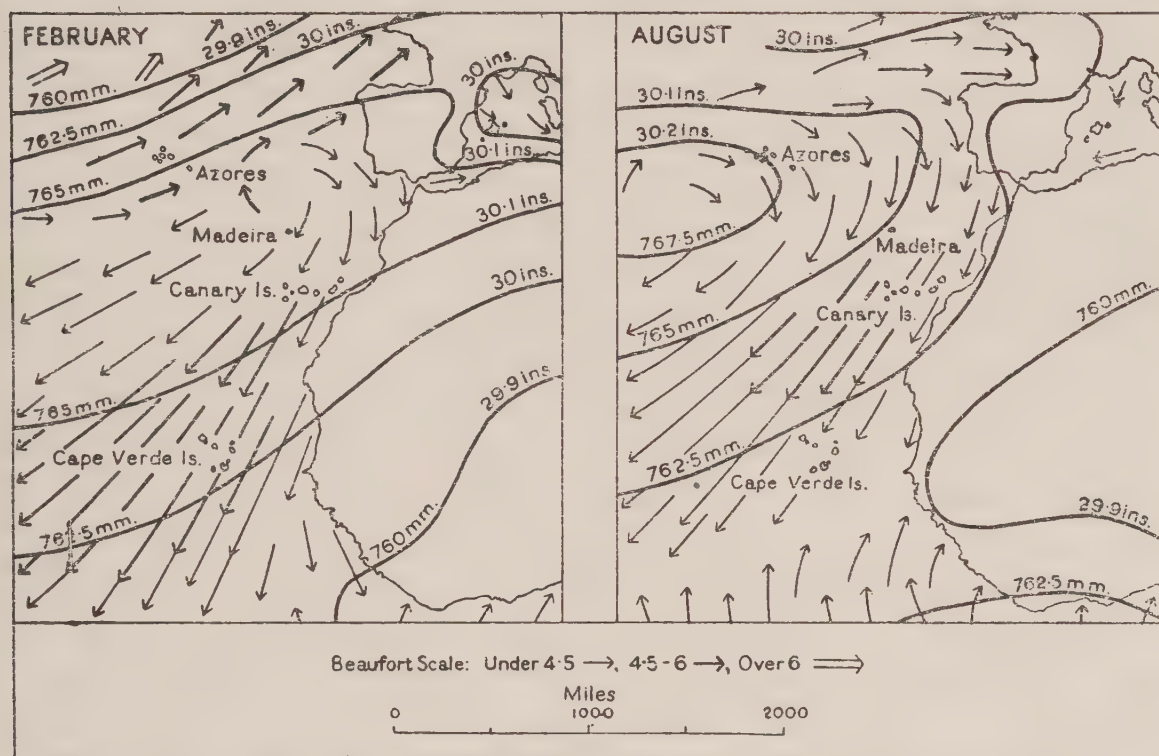
GENERAL ACCOUNT

Atmospheric Pressure

The average pressure is high over the mid-Atlantic just south of the Azores (Fig. 7). This pressure-system, the Azores 'high', tends to move north and south with the apparent migration of the noonday sun, being most southerly in February when, as demarcated by the isobar of 30.12 inches (1,020 mb.), it covers the

Atlantic between 18° N. and 35° N. and extends eastwards across north-west Africa. During the summer period (June–August) the Azores ‘high’ increases slightly in intensity and is confined to the Atlantic, being centred about lat. 35° N., long. 35° W.

Diurnal variations of pressure are not large enough to be important, whereas irregular changes, due to the passage of depressions, are of



great significance, although most of the atmospheric disturbances connected with the polar front pass well to the north of the Azores. Frequently, secondary depressions may form near this archipelago and, passing north of it, actually across it or, as happens often in autumn, between it and Madeira, may bring very stormy weather.

Winds

Prevailing Surface Winds. In the Azores north-easterly and south-westerly winds are most frequent, but there is no predominating direction; in Madeira and the Canaries the north-east trades strongly predominate, at least for the greater part of the year. As a general rule, the north-easterly component strengthens towards the south and with the advent of summer.

During the winter half-year (November–April) winds in the Azores

blow more often from a westerly than from an easterly quarter. Yet north-east and north winds are common, especially over Terceira and S. Miguel, and on arising are more likely to persist than the south-westerlies. A similar wind movement is to be expected in the Madeira group, where, however, a veering of the wind from south-east through south to north-west—associated with the passage of depressions to the north—is fairly common in winter. For this same reason, the frequent spells of north-easterly air movement in the Canaries may be interrupted by winds from between south-east and west. Here the southerly and more especially the easterly winds may bring dry, hot, dusty weather from the African mainland.

During the summer half-year (May–October) winds are light over the Azores and calms usually occur on about one day in every six or seven in July and August. The few winds come mainly from the north-east and north, except at Flores, where a south-westerly direction is still the most common. In Madeira and the Canaries, the north-east trades blow steadily at this season and in the latter group reach their maximum mean strength and persistency, having an average force of 4 or 5 against 3 or 4 in winter. Further details concerning winds and other climatic phenomena are given in Appendix D.

Gales. Since gales are chiefly associated with the passage of depressions, they are most frequent in winter and in the northern island groups. At sea near the Azores, gales have been recorded in from 10 per cent. to 12 per cent. of ships' logs during January and February; at Ponta Delgada in S. Miguel, the frequency of winds of 32 knots or over decreases from five a month in January and December to one every ten years in July. These gales blow mostly from a westerly direction and are most felt near Flores, but they have been known to come from the north and south-east. Some of the rare gales of late summer (July–September) appear to be due to tropical cyclones which usually travel in a direction between north-east and south-east and which may cause winds of hurricane force.

Off Madeira during the winter half-year winds of force 7 or over occur on 5 per cent. of occasions; gales are usually of short duration and mostly blow from the south-west and north-west. From May to September gales are rare and only to be expected on 1 day or less a month. Gales are still more uncommon all the year off the Canaries, although between November and February they may arise with dry south-easterly winds. Here, very occasionally, south-west and north-west winds may also be violent, the latter being shorter lived but of greater strength.

Local Winds. The direction and constancy of the general surface winds on all three island groups are considerably affected by topographic deflection and by the frequent occurrence of land and sea breezes. The local topographic effect is well seen in the Azores, where the mountain ring almost enclosing Ponta Delgada tends to fend off north-westerlies but gives free access to winds between south-east and south-west; at Angra only westerlies and south-easterlies have an unobstructed flow; and in the channel between Fayal and Pico where the orientation of the strait causes a local increase in the strength of south-westerly winds. The shape of the whole island-mass is also important. At Tenerife, and no doubt on other high islands, the turbulence and indraught on the lee side of the main peak may, when the trade is very fresh, form a local surface wind blowing onshore in an opposite direction to the trade. On Tenerife this return air-flow is called the *embate* (Fig. 10).

During fine weather, land and sea breezes are an appreciable and regular feature on all the islands. These breezes may reinforce, or weaken or even overcome, the general surface wind, but they are themselves much affected by topography and rarely extend beyond 10 to 15 miles inland. On clear days, with little air movement, the sea breeze tends to rise rather gradually in the forenoon, although at times it breaks suddenly as late as the early afternoon. It usually reaches its greatest development between 1500 hours and 1700 hours, and thereafter decreases, dying away after sunset. About 2200 hours, and occasionally later, a light off-shore breeze, the land breeze, may arise and last until day-break. The sea breeze is usually the stronger, except on steep coasts where the downward gravitation of cold air at night may reinforce the land breeze. As a general rule, the sea breeze increases the force of the general wind on the windward coasts of an island and decreases it on the leeward side, while the land breeze has an opposite effect. This influence can seldom be neglected. Thus, at Funchal winds at 900 hours and 2100 hours are mainly from a northerly point, whereas at 1500 hours they come mainly from a southerly quarter; in summer in the Azores an evening breeze (*torral*) blowing off shore is much used by small sailing-craft; on the lee side of the Peak of Tenerife the sea breeze occasionally so modifies the prevailing wind as to cause calms for some distance out to sea; at Orotava, also in Tenerife, south-east winds predominate in the early morning and north-east and north winds in the early afternoon.

Upper Air Currents. In the Azores group, and especially in the

western islands, west and south-westerly winds probably prevail above 10,000 feet. During the summer half-year, when the north-easterly winds extend from the surface up to 3,000 feet or 5,000 feet, the air movement above these heights is probably light and variable up to about 10,000 feet. This condition closely resembles that over Madeira in summer, where in all probability a westerly and south-westerly air movement predominates beyond 8,000 feet or 10,000 feet and up to 20,000 feet or more. In the winter months at Madeira, and especially from December to February, if northerly winds are established at the surface they usually extend, perhaps with an easterly component, to between 10,000 feet and 20,000 feet. In the Canaries an easterly drift of air is often encountered above the north-east trades and above that a westerly wind or anti-trade. Here the trades extend to a greater height in winter, when they are usually to be found up to 12,000 feet and even 15,000 feet, against an upper limit of 8,000 feet to 10,000 feet in summer. In the former season they are probably replaced at about 20,000 feet by westerly and north-westerly winds; in the latter, west-south-westerly winds predominate from 10,000 feet up to about 30,000 feet.

Temperature

The main characteristics of the temperatures of the three island groups are their equable nature, their warmth in winter, and their disregard of differences in latitude (Fig. 8).

February, usually the coolest month of the year, has mean temperatures of about 58° F. in the Azores and of 60° F. to 64° F. in the Canaries. Then night temperatures at sea-level normally fall to about 52° F. and occasionally to 48° F., but they very rarely, if ever, drop below 40° F. in the two northern groups and below 46° F. in the Canaries.

During August, the hottest month, the monthly temperatures average about 72° F. in the Azores and 74° F. in the Canaries. Towards the middle of the afternoon, 77° F. is usually and 80° F. to 84° F. occasionally recorded. The greatest known heat is not excessive, some of the highest recordings at sea-level being 83° F. at Ponta Delgada, 103° F. at Funchal (most abnormal and possibly an observational error), 90° F. at Puerto de La Cruz, and 101° F. at S. Cruz de Tenerife. In spite of the absence of long-term records, it is certain that the eastern Canaries can be extremely hot in summer; means of 97° F. for the hottest month and an absolute temperature of 108° F. up to 115° F. for the hottest day have been suggested.

The insular situation ensures that the diurnal range of temperature is only 10°F. or 12°F. for the year and seldom exceeds 14°F. for the month, the greatest range occurring in winter. On any one day it is unusual for the temperature to change more than 18°F. or 20°F. (Appendix B).

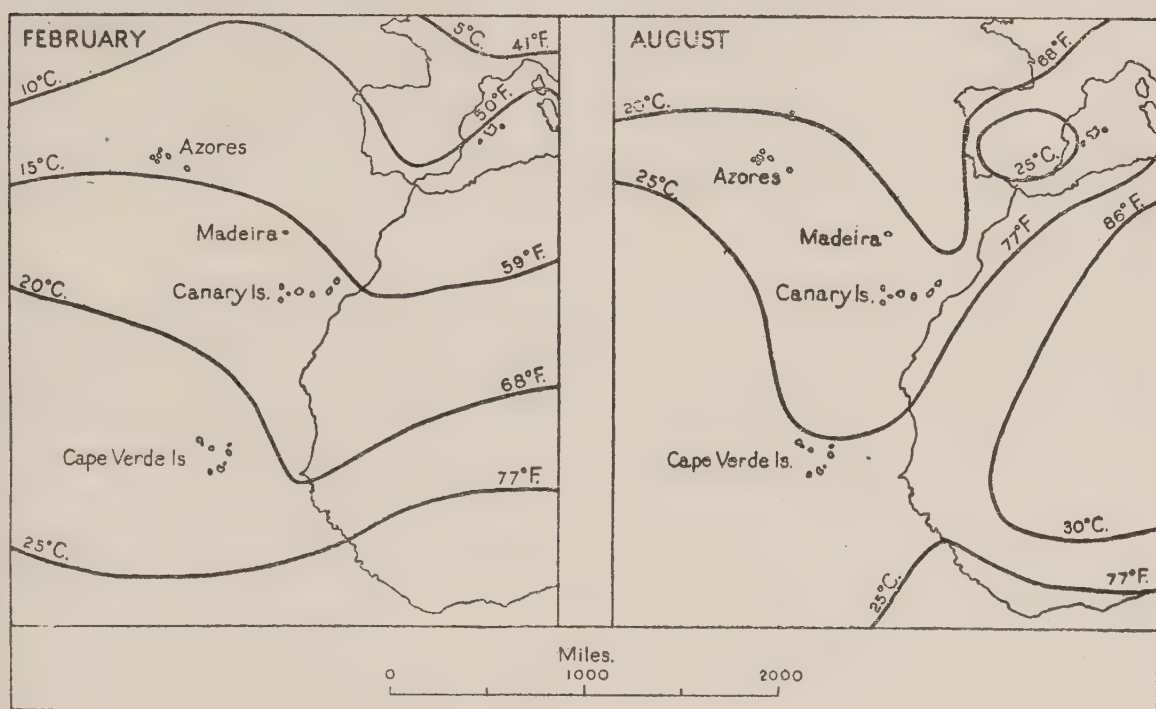


FIG. 8. *Mean Monthly Temperatures*

The decrease of temperature with increase of altitude varies slightly with the seasons and differences in exposure of the slopes, but may be taken to be about 3°F. for every 1,000 feet. The effect of this decrease up to 7,000 feet is reflected in the following statistics for stations in Tenerife.

Stations	Altitude in feet	Mean monthly temperature ($^{\circ}\text{F.}$)	
		February	August
Puerto de La Cruz .	70	61.6	73.3
Güimar . . .	1,200	57.6	73.6
La Laguna . .	1,774	54.3	71.5
Vilaflor . . .	4,335	47.6	67.7
Cañadas . . .	6,857	38.8	63.0

Although these statistics were mainly compiled from short-term observations and undoubtedly exaggerate the average heat at Vilaflor and Cañadas in August, they serve to illustrate the pleasantness of the warmth on the mountains in summer. The few records of absolute temperatures available for the same stations indicate

that the summer maxima temperatures undergo little or no decrease up to about 3,000 feet, since the effect of increasing altitude is counterbalanced by the diminution of the cooling influence of sea breezes. At these heights, however, the greater wind movement, increased evaporation, and lower relative humidity make the few heat-spells much more bearable. During winter occasional frosts are to be expected above about 4,000 feet in the Canaries and probably 3,000 feet in the Azores, but long spells of cold weather (near or below freezing-point) only occur on the higher islands above 6,000 feet and 7,000 feet.

Relative Humidity

In the three island groups the relative humidity at sea-level varies little during the day and during the year. Thus at Ponta Delgada early mornings from February to April have a mean relative humidity of 77 per cent. against the 73 per cent. at 4 p.m., while the corresponding figures from June to August are about 81 per cent. and 71 per cent. respectively. At Orotava (328 ft.) the mean relative humidity of January (71% at 7 a.m. and 66% at 2 p.m.) differs little from those of August (79% at 7 a.m. and 75% at 2 p.m.). Figures for the same periods and times at Funchal lie between still narrower limits (Appendix B), but here, and elsewhere on the coast, the moisture content of the air increases appreciably with the onset of the sea breeze.

The combination of fairly high temperatures and of moderately high humidities obtaining throughout the hotter months of the year causes the weather at most coastal stations to be 'relaxing' and at times to become definitely oppressive. It happens, however, that the moisture content of the air in summer decreases rapidly with ascent as well as with movement inland, and this decrease, coupled with a more active evaporation, causes the weather above a few thousand feet to be exhilarating. At the Cañadas (6,857 ft.) the mean relative humidity in August is only 24 per cent., and the dryness of the atmosphere—with the assistance of an evaporation that prevents perspiration forming on the skin—provokes a more than ordinary thirst in persons climbing the Peak.¹

Cloudiness

The mean amount of cloud-cover in the three island groups decreases considerably southwards, being about 7 tenths in the

¹ See water-supply (p. 146).

Azores, just over 6 tenths in Madeira, and $5\frac{1}{2}$ tenths in the western Canaries (Fig. 9).

During the winter half-year in the Azores there is much cloudy, rainy weather when 7 tenths to 8 tenths or more of the sky is covered. At Horta the sky is almost completely overcast on more than 12 days each month. During the summer half-year the mean cloud-cover over the Azores is about 6 tenths to 7 tenths, clear days being least infrequent from July to September, and August being the

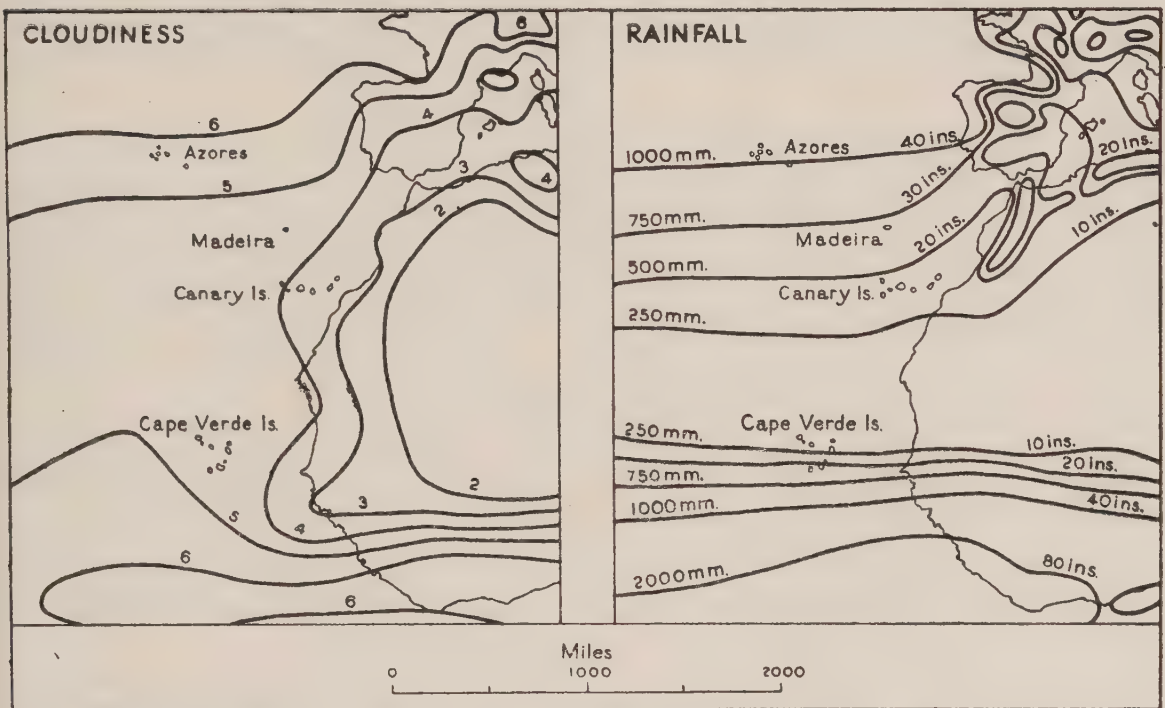


FIG. 9. *Mean Annual Cloudiness and Rainfall.*
Cloudiness in tenths of sky covered

clearest month (under 6 tenths). In September and October there is usually less cloud below 3,000 feet than from May to August. Throughout the warmer months the cloud base tends to rise during daylight, and the afternoon and evening are usually less cloudy than the early morning.

At all times of the year the western islands normally have much more cloud than the eastern, Flores having about 190 overcast days annually, or twice the number at Ponta Delgada. On all the higher islands of the Azores, as well as of the Madeira and Canaries groups, when a sheet of cloud forms on the windward side of the mountains, the cloud-cover on the lee side is usually broken and may on some days be greatly diminished.

Madeira is much less cloudy than the Azores. During the winter half-year it is usual for 6 tenths to 7 tenths of the sky to be covered,

November to January being the cloudiest periods. The cloud-forms are those associated with depressions, and the cloud-cover may extend to great heights. From May to October the average cloudiness is 5 tenths to 6 tenths, the sky being clearest in August. At any time of the year, and more especially in summer, it is common for the amount of cloud to increase appreciably between dawn and the later afternoon and to decrease again towards evening.

The cloud-cover over the Canaries varies relatively little from month to month, December to February being normally the clearest months (under 5 tenths) and March to June the cloudiest (6 tenths).

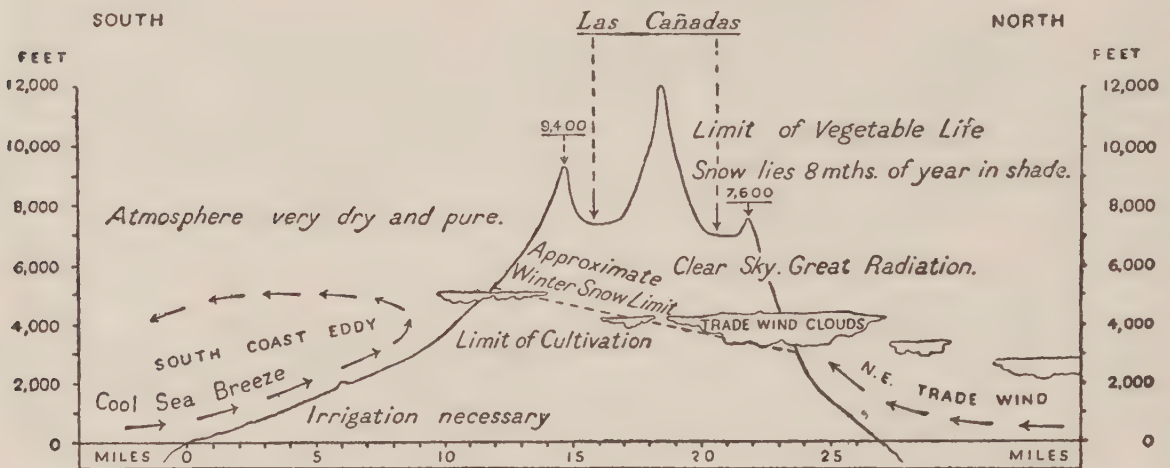


FIG. 10. *Cross-section of main Climatic and Vegetation Zones of Tenerife.*
Vertical scale is exaggerated six times

Throughout the year cumuliform clouds tend to prevail over the open sea, but the trade winds in summer may produce a layer of cloud about 500 feet thick with its base at 2,500 feet or 3,000 feet above sea-level. The cloud-banks of strato-cumulus and detached cumulus formed on the lower and middle mountain-slopes usually lie at 500 feet to 1,000 feet above the cloud-sheet associated with the open sea. Farther inland, however, the clouds formed by topographic influence may be as high as 6,000 feet or 7,000 feet (Fig. 10). The above statistics refer to coastal areas and consequently do not show the normal rapid decrease in cloudiness on lee slopes and at increasing altitudes away from the seaboard in the Canaries. The Peak of Tenerife permanently surmounts the trade-wind layer, while the summits of a few of the other main islands occasionally surmount it. The Peak is remarkably free from cloud; thus in January, Las Palmas at sea-level has an average of about 9 clear and 9 cloudy days, whereas the Cañadas at 7,000 feet has 13 clear and 1 cloudy day. In July the former has 7 clear days against 27 at the latter.

From June to the end of August it is seldom for more than 1 tenth of the sky to be covered over the Peak, and even lower stations such as Güimar (1,200 ft.) then normally have only 2 tenths to 3 tenths of the sky overcast.

Precipitation

As a general rule the precipitation of the Azores resembles that of the British Isles, whereas the precipitation of the Madeira group is akin to that of the Mediterranean seaboard, and the rainfall of the Canaries falls half-way between the Mediterranean and the Saharan types (Fig. 9).

In the Azores the rainfall decreases markedly eastwards, Flores having nearly 60 inches a year against the 29 inches at Ponta Delgada. On the eastern islands about 3 to $3\frac{1}{2}$ inches of rain a month normally falls from October to February; in the extreme west (Flores) the mean monthly falls increase up to 6 inches and the wet period extends into March and even April. Rain, usually as showers but occasionally as a continuous downpour, is to be expected on about 1 day in every 2 on Flores and on about 2 days in every 5 elsewhere.

During the drier period of the year the average falls are about 2 to 4 inches a month in the west and 1 to 2 inches in the east. Showers, usually short but at times copious, normally occur on 1 day in every 4 or 5. The driest month is July when some of the eastern coastal areas commonly have less than 1 inch of rainfall.

Snow does not fall at sea-level in the Azores and only lies for any length of time on the summit of Pico. Hailstorms are experienced on about 3 days a year at Ponta Delgada and on 7 days a year at Horta and Flores; they occur chiefly at the cold fronts of depressions in winter, and at Horta also during local thunderstorms. Thunderstorms are not frequent, there being about 7 a year in the eastern islands and 12 in the central islands; about one day with thunder a month is to be expected from November to April and less than one a month in summer when, however, a few heat storms may develop, especially on Fayal.

Madeira is less rainy than the Azores, its dry season being longer and more intense, and its rains, although copious, being much less frequent. The annual rainfall at sea-level is about 25 to 28 inches a year, falling all told on 65 to 75 days. The rainy season extends from October to April, when 3 to 5 inches of rain and 6 to 9 rainy days a month are common. November with 5 inches is usually the wettest month at Funchal. Thunderstorms are rare (4 or 5 a year)

and come mainly in winter. The weather is much drier from May until the end of September, the normal fall being 1 inch or less a month on 1 to 4 days. The driest period, from June to August, has seldom more than 1 or 2 short showers a month, and in some years is quite rainless.

Away from the coast the precipitation varies considerably according to the relief. In the severest weather snow may lie for a few hours at altitudes as low as 2,500 feet on the north side of Madeira and 3,000 feet on the south; in the higher parts the snow-cover may temporarily be quite deep. On the summit areas the rain in winter may continue from morning to night, whereas on the south and near the sea even the wettest days usually have bright intervals. Here the cloud-banks are scattered in a brilliantly blue sky; the storm gathers and breaks suddenly, the sun soon reappears and the ground dries in a very short time.

The precipitation of Madeira is less regular than that of the Azores; the wet season may bring heavy downpours and the dry season may be persistently rainless. Thus in the very rainy winter of 1895-1896 over 18 inches fell at Funchal in October and 9 inches in February, after which absolute drought persisted for many months.

This tendency is still more marked in the Canaries, where the annual rainfall is smaller. On the western and northern coasts of the main islands of this archipelago the yearly averages are 16 to 18 inches, which fall on a total of 50 to 60 days. From October to March, 2 to 3 inches of rain and 6 to 9 rainy days each month are usually experienced; from April to September more than 1 inch a month is uncommon, and there is very little rain from June to September. July is practically rainless, there being on an average one short, light shower every 5 years or more; in June and August no rain at all is to be expected in every other year.

The annual rainfall on southern and eastern coasts of the main islands is usually a few inches less than on the other coasts; at Las Palmas the average is about 10 inches a year, and at Güimar about 9 inches. At the latter place, few months have over 1 inch of rainfall or more than 7 days with rain, and the dry season (under 1 inch a month) normally extends from February to September.

Nor are the higher parts of the islands much more fortunate. Las Cañadas averages only 14 inches of precipitation annually, and rain seldom falls on more than 25 days a year. The most arid parts of the Canaries are found, however, in Lanzarote and Fuerteventura, where the few records available suggest that the annual totals average about

8 to 10 inches and that not more than 15 inches nor less than $2\frac{1}{2}$ inches of rain can be expected in any one year. These islands undergo remarkably long periods of drought, and two to three consecutive years have been known to be practically rainless.

Throughout the Canaries thunderstorms are rare and occur only 2 or 3 times a year, mainly during the winter months. Snow does not fall below 4,000 feet in Gran Canaria, and below 3,000 feet on the north side of Tenerife and 3,500 feet on the south side. At these altitudes it is very exceptional and does not remain more than a few days. Las Cañadas has about 8 days with snow each winter, while the upper parts of the Pico de Teide are snow-clad for several months every year.

Visibility

Fogs are uncommon in the neighbourhood of the Azores, and normally visibility is restricted to under 1,100 yards on only 6 or 7 days a year at Ponta Delgada (Appendix B). From December to April about 1 day a month may experience fog, which, however, is usually of short duration. At other periods, and especially in July and August, fogs are rare, but those that do occur tend to persist longer than in winter. In spite of the infrequency of fog, visibility during the year is not uncommonly impaired by a sea-haze of a shallow nature that makes recognition of height above the water difficult for aircraft.

In Madeira, visibility at sea-level rarely falls below 2 miles. Fog or mist occurs on about 16 days a year at Funchal, and of these 2 a month are usually recorded from October to March. In the warmer period of the year, fog is to be expected on about 1 day a month, except in July and August when its occurrence is most unusual. During the cooler season the worst visibilities occur with winds from between south-east and west, and are slightly more frequent in the early morning than later in the day. In the warmer months easterly winds from Africa may cause a dust-haze which is usually more pronounced in the upper layers than near the surface.

Visibility at sea-level is also generally good in the Canaries, and, at S. Cruz de Tenerife, is restricted to less than 2 miles on only 6 or 7 days in a normal year. Fogs and poor visibility are least unusual in January and February when they occasionally occur with westerly winds; at other periods fog is not to be expected on more than 1 day in every 2 or 3 months. Reduced visibility during summer,

and occasionally at other seasons, may be caused by dust carried by easterly winds; as in Madeira, the haze is often denser in the easterly drift lying above the north-east trades than at sea-level.

Rough Sea and Swell

Winds of force 4 or more and/or an appreciable swell occur near the islands on the following number of days in each month.

	<i>Jan.</i>	<i>Feb.</i>	<i>Mar.</i>	<i>April</i>	<i>May</i>	<i>June</i>	<i>July</i>	<i>Aug.</i>	<i>Sept.</i>	<i>Oct.</i>	<i>Nov.</i>	<i>Dec.</i>
Azores .	23	19	19	18	10	6	3	2	8	14	17	22
Madeira .	12	12	16	12	8	6	9	8	7	12	13	13
Canaries .	8	6	11	7	7	6	9	7	4	9	8	9

The table shows that the probable occurrence of strong winds and high seas decreases towards the south in winter and increases in summer. Off the Azores rough seas are to be expected on about 2 days in every 3 from November to April inclusive, such conditions being most frequent in December and January. The warmer months are much calmer, especially in July and August, when high waves prevail on only 1 day in every 10 or 15. Heavy swell is seldom experienced between mid-April and late September. On at least two-thirds of the recordings given for any month in the above table, the wind was from between south-west and north, north-westerly and south-westerly winds being most common. Rough seas rarely accompany winds from between east-north-east and south-east (pp. 27-28).

Off the coasts of the Madeira group, high winds and/or swell occur on about 2 days in every 5 from October to April, the frequency being highest in March. During the warmer months, May to September inclusive, rough sea is to be expected on about 1 day in every 4.

Off the Canary islands the sea is likely to be rough on one day in every 3 or 4 at any period of the year. On the coast even in calm weather the size and force of the breakers may be quite impressive. Here, as in Madeira, rough seas and swell nearly always come with winds between north-west and north-east, the latter predominating; such conditions rarely occur with winds between south-west and east-north-east.

In all three island groups the sea-breezes may appreciably increase the force of winds on windward shores during the afternoon, especially between April and October. This effect has not been taken into consideration in the compilation of the table given above.

CHAPTER IV

FLORA AND FAUNA

FLORA

Affinities and Origin

THE vegetation of the Atlantic islands, and especially of the Azores, was relatively limited in species when first discovered by Europeans. Subsequently there has been a continuous introduction of useful trees and plants, particularly of those yielding timber or marketable fruits. To-day the general character of the flora of the Azores and Madeira is decidedly south European with a fairly high proportion of endemic species and a sprinkling of north African forms. In the Canaries the proportion of endemic and north African types is much greater than in the other groups, and tends to predominate. Here, 30 per cent. of the native plants are peculiar to the archipelago against 10 per cent. in the Azores. Expressed numerically, the indigenous forms that have survived or developed, either as distinct species or as strongly marked varieties, exceed 40 in the Azores, 100 in Madeira, and 300 in the Canaries. These differences in the richness and composition of the original flora probably arose because the island-groups are not of the same geological age and are situated at widely different distances from the nearest continent. Thus it is highly probable that waves of African, Asiatic, and American plants passed in successive ages over the Canaries and Madeira before the Azores were available for plant-stocking. The influence of the adjacent mainland was naturally strongest in the Canaries, where the indigenous African flora includes the stately Canary pine, several species of laurel, such as *Laurus canariensis* and Madeira mahogany (*viñatigo*), the aloe, the oleander-leaved kleinia, the cactus-like euphorbias, the balo (*Plocama pendula*), and the dragon-tree. In all three archipelagos, however, the parent stocks came mainly from the lands bordering the Mediterranean, and each island-group preserves some plants that grew in southern Europe in Upper Tertiary times. In other words, remnants of the flora that was destroyed in southern Europe during the Ice Age have been preserved here and have developed in insular seclusion at least since the Pliocene Age.

The nearest connexions of the endemic flora of the Canaries have been carefully studied. Here over one-third of all the endemic genera have affinities with the Mediterranean region of Euro-Africa,

and these include a fern (*Adiantum reniforme*) known to exist in Portugal in the Pliocene Age, and a laurel (*Daphne Gnidium*) and a juniper (*Juniperus Oxycedrus*) which are characteristic of the vegetation of the Great Atlas mountains. Hardly any endemic forms in the Canaries are represented in tropical west Africa, but about 40 genera have their nearest relations in east Africa. A further 8 or 9 genera have their closest affinities in eastern Asia and another 10 or 11 in the New World. In the latter category is included the fern *Woodwardia radicans* SW., that grows freely in damper localities in the Canaries and the Antilles, and an ericaceous tree (*Clethra arborea*), surviving also in Madeira, that is allied to the American types of this genus. The connexions with the vegetation of the east coasts of the Americas may have arisen from seeds carried by the general circulation of the surface waters of the North Atlantic Ocean. In contrast to this method of dispersal, it may be noticed that the connexions between the endemic flora of the individual archipelagos has almost certainly been maintained by the migrations of frugivorous and wading birds, large flocks of which frequent all the island-groups.

To the endemic flora must be added the great number of plants imported deliberately or, in some cases, unwittingly by man. These include most of the taller trees, the majority of the commercial fruits, and many of the more ornate shrubs. In the Azores, for example, there was a great poverty of species of tall-growing trees until the nineteenth century when the pine, poplar, palm, eucalyptus, chestnut, tulip, elm, oak, and many others were introduced. In this island-group, as in Madeira and the Canaries, the vegetation of the lower cultivable areas was almost completely changed by man's introductions. Nor did the plants on the higher areas always escape interference, as is to be seen in Madeira, where several of the native trees and shrubs survive only in the most inaccessible places and some are now almost extinct. By way of contrast, many of the plants of foreign origin have spread to a remarkable extent, as the commonness of the prickly pear (*Apuntia Tuna*) and the cluster pine (*P. pinaster*) will testify. In the western Canaries the sub-tropical climate and the climatic effect of the mountains have allowed the successful introduction of almost any species of tree or plant characteristic of warm and of temperate zones. However, in many of the more arid and uncultivable areas of this archipelago, the native flora flourishes and it is obvious that the local conditions are all against intruders.



13. *Wooded slopes above Lagoa das Furnas, S. Miguel*



14. *Euphorbia canariensis near Juan Grande, Gran Canaria*



15. *Banana plantation, Madeira*



16. *Woods of the Ribeiro Frio, Madeira*

Abundance and Composition

The species of flowering plants growing wild number about 600 in the Azores, over 700 in Madeira, and about 900 in the Canaries. The flora, especially in the northern island-groups, is particularly rich in varieties of shrub, heath, juniper, and of grasses. Mosses, ferns, and lichen also abound in the damper areas; on the wetter islands of the Azores they grow freely on walls and roofs even near the coast, while in Madeira there are 40 species of ferns, 100 of mosses, nearly 50 of *Hepatica*, and 145 lichens, many of which flourish exceedingly, the ferns especially growing in great profusion. Even the Canaries, with a much drier climate, have about 30 species of ferns.

In fact, however, it happens that the flora of the larger islands of the two northern archipelagos is often more striking for its exuberance than for its wealth of species. In parts of the Azores and large areas of Madeira the plant-cover is almost tropical in its luxuriance (Photo. 13). The splendour of the gardens, although of little botanical interest, is of great economic value as an attraction to visitors. In Madeira during winter and spring there is a wealth of roses, camellias, rhododendrons, azaleas, geraniums, begonias, bignonias, daturas, bougainvilleas, wistarias, poinsettias, plumbago, hisbiscus, hydrangeas, agapanthus, cannas, arum lilies, and many others. Moreover many of these flourish in a wild state.

The vegetation of the western Canaries is more varied than that of Madeira, but it is less exuberant and is only abundant in the irrigated areas and in the forest-belt of the trade-wind cloud zone. The difference is well seen in the extent of the gardens which here, although containing a wealth of most of the flowering plants named above, are but small oases in a more barren landscape. The aridity of the climate causes large tracts of Gran Canaria and Tenerife to be almost devoid of vegetation, while the eastern Canaries, apart from small irrigated patches, are practically desert. Nor does proximity to the seaboard relieve the barrenness, since large areas of the coastal sands are not stabilized. From a scenic point of view the flora of Madeira might be characterized by the flowering shrub, whereas that of the Canaries would be better represented by the cactus-like *Euphorbia*, 25 species of which are known to exist in the archipelago, 9 of them being peculiar to it (Photo. 14). Here, too, the cultivated areas are covered in summer and autumn with a thin mantle of dust, while the plants of Madeira and the Azores retain their freshness throughout the growing season.

Vertical Distribution

In the Azores and Madeira the zone of intensive cultivation extends to about 1,500 feet on north-facing slopes and 2,000 feet on south-facing slopes, many of which are carefully terraced. Here the banana, fig, pomegranate, orange, lemon, citron, Japanese medlar, tea, tobacco, and numerous other crops are grown successfully. Palms are rare in the Azores but are common enough in Madeira.

From about 1,500 feet to 3,000 feet cereals, grasses, and trees predominate, the chief plants of this zone being maize, wheat, barley, oats, osiers, apples, pears, peaches, and most other temperate fruits, eucalyptus, bay laurel, til, chestnut, viñatigo, pines, oaks, and tree ferns. From about 3,000 feet up to 5,000 feet the vegetation consists largely of shrub, the main types being bay laurel, til, viñatigo, heath, and bilberry. Large tracts of the higher mountainous parts of this zone are covered with two heaths of arborescent growth and a whortleberry. There is very little vegetation above 5,000 feet, except a few heaths, patches of grasses, and an occasional fern, but the areas above this height are also insignificant (Photos. 15-17).

The vertical distribution of the flora in the western Canaries has received much attention from botanists. Here, however, as in the two other archipelagos, strict demarcation of the vegetation zones is very difficult owing to the different amount of rainfall that falls on northern and southern sides of the islands and owing to the varied nature of the substrata. Consequently, there is much overlapping of zones and as a rule evergreen woods are more developed on the wetter northern slopes than the drier southern slopes. On the whole, the vegetation zones of Tenerife are more clearly defined than those in the other islands of the Canaries group.

Tenerife

On Tenerife there are three main zones: the Coastal, the Cloud, and the Alpine zone, each of which can be further subdivided (Fig. 11). The various divisions and subdivisions are these:

I. Coast Region and Lower Slopes up to 2,400 feet

a. Foreshore and Coastline

This narrow belt has a varied and cosmopolitan vegetation, representative of which are such genera as *Mesembryanthemum* (ice-plant) and *Frankenia*. Euphorbias are very common, as also are the Paris daisy (*Chrysanthemum frutescens*) and several species of the endemic flora.

b. Desert and Semi-desert Areas

These are almost entirely confined to the south-east and south-west coastal regions. Here miles of rock-strewn country are given over to the prickly pear, especially that which acts as a host for the cochineal bug, and to various species of *Euphorbia* and *Sempervivum*.

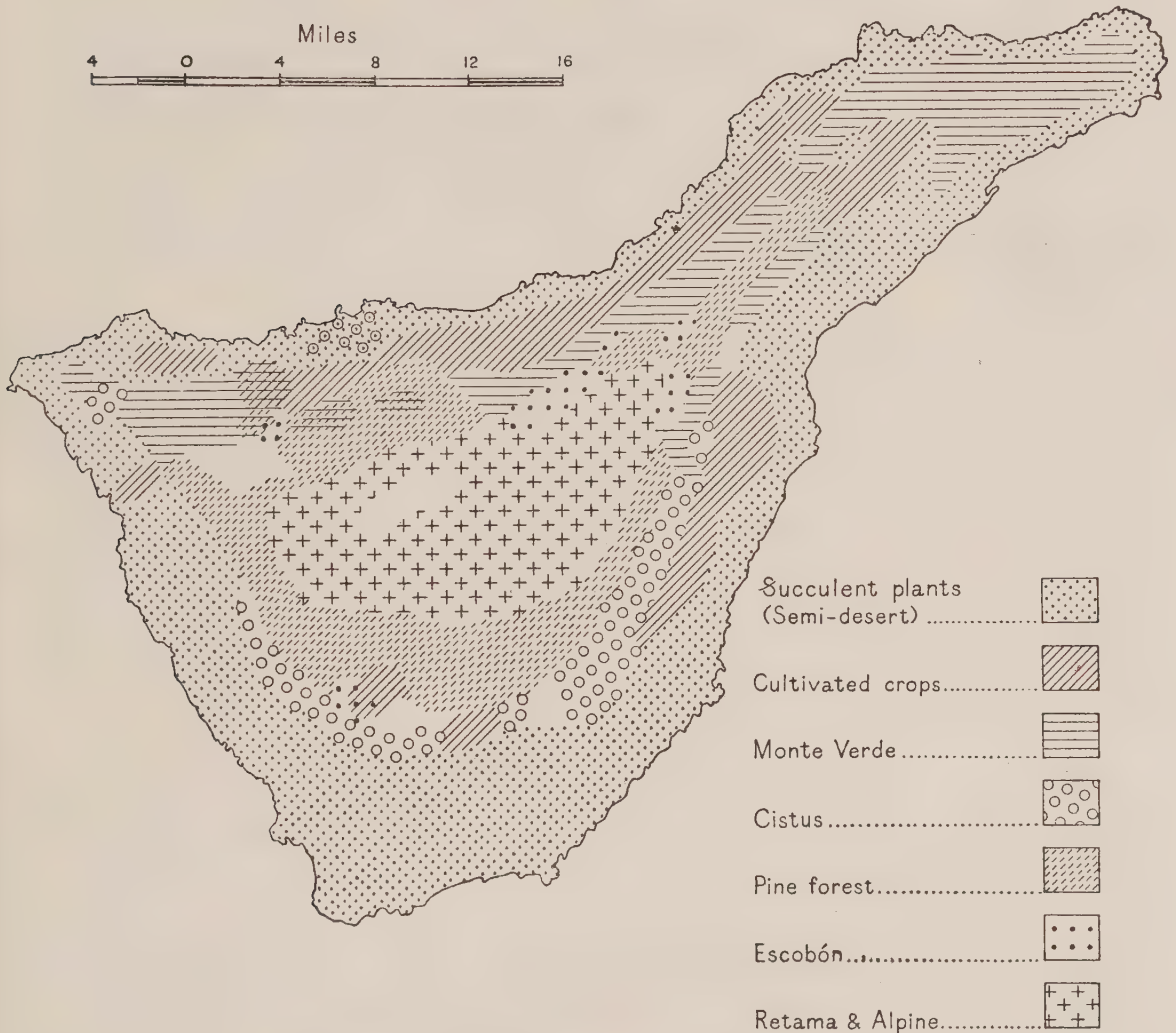


FIG. II. *The Vegetation of Tenerife*

The native vegetation illustrates every possible adaptation to semi-desert conditions. Except for the bright green whip-like branches of the balo (*Plocama pendula*), its general aspect is grey, many plants being either glaucous or covered with a silky, mealy, or hoary pubescence. The leaves of some contain aromatic juices; others depend for protection on their leathery nature or on an armament of spikes; others have a reduced leaf-surface, and many, such as the larger species of *Sempervivum*, are very deep-rooted. In parts there are thickets of cactus-like *Euphorbia canariensis*, each stiff quadrangular column beset with rows of spines. These thickets are often

overgrown by the climbing Asclepiad, and afford protection from goats for numerous other desert shrubs. The curious Asclepiad (*Ceropegia dichotoma*) appears as a cluster of fleshy, upright, jointed meal-covered stems in appearance not unlike a bunch of wax candles. The few grasses are of characteristically desert type. *Sonchus spinosus*, which has no foliage after the seedling stage, suggests a tangle of barbed wire, while *Citrullus Colocynthis* has gourds the size of oranges. A few of the leafy arborescent species of *Euphorbia*, when growing under favourable circumstances, will reach 12 feet in height, but in exposed situations on the coast they may become prostrate and appear as a mass of writhing fleshy arms. The miniature Dragon-tree (*Kleinia neriifolia*) is very similar in appearance to some of the Euphorbias.

c. Lower Cultivated Zone, up to 1,300 feet

The chief crops in the better-watered, low, sub-tropical districts are the banana, orange, lemon, vine, yam, coffee, pepper (pimentero), sugar-cane, and tobacco. Here too thrive the mango, camphor, eucalyptus, cork-oak, tamarisk, araucaria, magnolia, fig, Japanese medlar, and about 25 kinds of palms, including the tall Canary palm (*Phoenix canariensis*), the royal palm, the date palm, and (in La Palma) the coco-nut palm.

d. Upper Cultivated Zone, 1,300 feet to about 2,400 feet

Here the chief crops are wheat, maize, the potato, lupine, and broad bean; where the rainfall is sufficient, as on the La Laguna plateau, a number of trees thrive, including the eucalyptus, laurel, palm, fig, chestnut, walnuts, and almond. The rocky uncultivable sides of the barrancos are not infrequently overgrown with the aloes, the cactus-like Canary spurge (*Euphorbia canariensis*; Spanish cardón), the tabayba (*E. Regis jubae*), the orchilla lichen, and about sixty kinds of house-leek (*Sempervivum*).

II. Cloud Region, from 2,300 feet to 5,300 feet

a. The Monte Verde Zone, 2,300 feet to 4,000 feet

This is characterized by woods and thickets of shrubs, especially evergreen (laurel, holly, and arbutus) which, however, in no sense form a continuous belt. The Monte Verde above Güimar consists largely of low evergreen scrub, in which the tree-heath, faya, small-leaved holly, and cistus predominate. Here various shrubs commence

at just over 2,000 feet, but the Monte Verde proper is not entered till about 2,700 feet. In this area, patches of vegetation on the south side of the barranco del Río includes numerous specimens of the madroña (*Arbutus canariensis*), an indigenous tree with smooth, shiny red limbs and trunk, averaging 3 to 4½ feet in circumference a yard from the ground.

b. The Pine Forest Zone, from 4,000 feet to 6,000 feet

The characteristic species is the Canary pine, but tree-heaths (especially in the island of Gomera), the faya, and Canarian laurels are fairly common in some localities (Photo. 18).

c. The Codeso Belt, from 6,000 feet to 6,500 feet

In this zone two shrubby, foliose leguminous plants predominate, the one being the escobón (*Cytisus proliferus*), a silver-leaved shrub covered in spring with white blossoms, and the other the codeso (*Adenocarpus viscosus*), a dark green shrub bearing golden-yellow flowers very similar to the gorse. These two species form the chief fodder-plants of the Canaries.

III. *Above the Clouds, 6,500 feet to 12,162 feet*

There is not sufficient soil to support an Alpine flora in Tenerife, the only species reminiscent of the Alps being the perennial herb, *Arabis albida*. The high barren slopes may be divided into two floral zones:

a. The Retama Belt, from 6,500 feet to about 10,500 feet

The retama is a dark-green broom which grows on the pumice-covered floor of the Cañadas and on the lava-strewn slopes of the Peak in places up to 10,500 feet. The plant bears white and pink flowers and its foliage lasts only from May to July.

b. The Alpine Zone, from about 10,500 feet to 12,180 feet

This belt is snow-clad for much of the year and has no vegetation except an endemic viola, a moss, and a black, crustaceous lichen.

The vertical distributions of flora discussed above apply in a general way to most islands of the three archipelagos. Where the distribution of vegetation of any island differs markedly from the general scheme, further details of its flora are given in the detailed descriptions of the individual islands (Chapters X–XII).

Forest and Woodland

Many of the lower hill-sides of the larger islands of the Azores are covered with coniferous forests, partly the outcome of recent replanting. The cluster pine predominates, but the Spanish chestnut, eucalyptus, and bamboo are fairly common. The woods of faya, a species of beech that gave its name to the island of Fayal, have long been destroyed.

Madeira was called the 'island of timber' because on its discovery 'there was not a foot of ground that was not entirely covered with great trees. It was therefore first of all necessary . . . to set fire to them. By this means they razed a great part of the forest. Upon the eight streams of considerable size which flow through the island, there are sawmills continually working timber and planks for the supply of all Portugal and elsewhere. Of this timber two kinds are esteemed: one of cedar, which is very odorous and resembles cyprus. Very beautiful tables, chests, and other furnishings are made from this. The other kind is yew, which is equally attractive, rose-red in colour' (Cadamosto, 1455).

To-day, remnants of the original forests are confined to a few ravines on the north coast. In these localities indigenous species such as the dragon-tree, various laurels, the lily-of-the-valley tree, the til (*Oreodaphne foetens*), and a fine species of bay have managed to survive. A juniper (*J. Oxycedrus*) growing to a height of 40 or 50 feet (the 'cedar' mentioned by Cadamosto) has almost been exterminated. There has, however, been an extensive replanting of pine as well as of European deciduous trees and of tropical and sub-tropical evergreens. In the absence of an indigenous pine, large tracts on the hills have been planted with the cluster pine from which the fuel of the inhabitants is largely derived. The owner usually allows some neighbouring peasant to sow the pines together with a crop of barley and to take the barley for his trouble. It may need two or three sowings before the pines start growing by this method, but once started they thrive and renew themselves. Within 3 or 4 years the trees are large enough to make trellises for vines and in 5 years to make vine-props. In 7 to 12 years they can be chopped for firewood and at this stage are usually sold by auction. The trees will not supply planks a foot wide under 20 years.

The small areas of natural forest remaining in Madeira have little economic value except the charcoal made from heather and laurel, and the grazing they afford for cattle.

In the Canaries so much of the forest has been felled that it is rare to find pines growing below 2,500 feet and most of the *pinares* com-



17. *Grassy summit near Poiso, Madeira*



18. *Forest on the slopes of Pico de Teide, Tenerife*



19. *Canary pines near Agaete, Gran Canaria*



20. *A Dragon tree in Tenerife*

mence only at about 4,000 feet. The chief forest trees are the slow-growing Canary pine which gives a valuable timber and will live up to about 7,500 feet; the palo blanco (*Notelaea excelsa*), a hard white wood; the viñatigo (*Persea indica*) or native mahogany; the barbusano (*Apollonius canariensis*), a dark wood of great strength and endurance used for making the beams of wine-presses; the til, also a hard dark wood; the Canary laurel, and several heaths, one of which will attain 40 feet in height and over 5 feet in girth. The timber of several of these species has a density greater than that of water.

The finest pine forests in the Canaries are those of Gran Canaria and La Palma; in Tenerife there are small stretches remaining in the Anaga peninsula, and more extensive patches on the higher flanks of the main mountain backbone. In the latter island the Monte Verde may locally develop into the status of forest, as happens on the Mercedes hills north-east of the plateau of La Laguna where, at heights of 2,500 feet to 3,000 feet, the Canarian laurels and Giant heaths are sufficiently thick to afford shade all day long and to exclude a profuse undergrowth (Photo. 19).

The most famous plant of the Canaries is the dragon-tree (*Dracaena draco*), which probably grows wild nowhere else in the world. The tree at Orotava, reputed to be of a tremendous age, was destroyed by a hurricane in 1867; the best specimens to-day are preserved in gardens, the largest (near Icod in Tenerife) being over 40 feet in circumference at 10 feet from the ground (Photo. 20).

FAUNA

Affinities, Origin, and Abundance

As is usual in the smaller oceanic islands, the Azores, Madeira, and the Canaries had no indigenous mammalia at the time of their discovery. It is true that the dog, swine, goat, and sheep were found on the Canaries by their Spanish conquerors, but these animals had almost certainly been introduced by earlier invading peoples from Africa. The fauna of all three island-groups shows marked affinities with that of southern Europe, even the animal- and insect-life of the Canaries being more closely allied to species inhabiting southern Europe than to those of Africa. In the three archipelagos the fauna as a whole is relatively poor in species, and the dearth of indigenous land mammalia is almost equalled by that of frogs, fresh-water fishes, and reptiles. It follows that the interest of the animal-life lies mainly in the birds. The insects and terrestrial molluscs have also attracted

much attention since they too illustrate the effect of long isolation from their parent stocks. The degree and the duration of the isolation are both significant, and it is not surprising that the fauna generally is richest in species in the Canaries and poorest in the Azores. As a general rule in any branch of the fauna, the Madeira group has double the number of species to be found in the Azores, and the Canaries have half as many again as those in Madeira.

Composition and Geographical Distribution

Mammals. To-day in most of the islands the ferret, rabbit, cat, rat, mouse, bat, and various domestic animals have become naturalized. On a few of the islands some of these tame animals, notably the cat and goat, have reverted to the wild state and are now hunted. Only one species of bat is common in the Azores and three or four in Madeira and the Canaries.

Birds. The birds of the Atlantic islands have long attracted the attention of British ornithologists. In the Azores about 120 species have been collected, of which less than 30 breed here. The only peculiar bird is the grey bullfinch (*priolo*) of western S. Miguel, and, this seems to be dying out. Three birds, the little goldfinch, the green canary, and Heineken's blackcap, are only found elsewhere in Madeira and the Canaries.

Over 200 different kinds of birds have been recognized in the Madeira group, 40 of which breed here. Among the residents are the kestrel, buzzard, barn owl, pigeon, the quail, red-legged partridge, woodcock, tern, gull, 2 petrels, and 3 puffins. Four very distinct and a few other less apparent forms are peculiar to this archipelago; five species, including a chaffinch, a swift, a wood-pigeon, and a petrel, are not found elsewhere except in the Canaries.

In the latter islands about 220 species of birds have been collected and 75 of these breed locally, including 42 or 43 forms which are peculiar to one or more islands of this archipelago. Among the notable birds of the Canaries are a large blue chaffinch peculiar to Tenerife, with a sub-species in Gran Canaria, both confined to the zone of pine forests; the Houbara bustard and black oyster-catcher which occur only in the eastern Canaries; the black-breasted sandgrouse and the Canary chat that are restricted to Fuerteventura; two species of pigeon, very distinct from the peculiar pigeon of Madeira; the grey-green canary, here limited to the western islands; and the trumpeter bullfinch and cream-coloured courser, true desert species

largely confined to the arid plains and foothills. The distribution of species in the archipelago itself shows some anomalies. Thus, the chough occurs only in La Palma, where it abounds, while the kite has never been recorded from La Palma although it is common in Gomera and Tenerife.

The rocky coasts of many of the islands in all three archipelagos harbour sea-birds, migrant or resident. The little Allied shearwater and the night-flying Bulwer's petrel breed under boulders, while the great shearwater (or *pardela*) may nest in holes near the coast or it may fly some way inland to nest in caves, lava-flows, old craters, and the sides of barrancos. The sea-birds of the larger Selvagem island are typical of those of the many small islands hereabouts that are little frequented by man. There abound in Selvagem Grande the great shearwater, as big as a large gull, dark brown above and white below, with a long, hooked bill, that nests in every sizeable cranny; the little shearwater, a neat black-and-white bird as large as a starling, with bright blue legs; the long-legged frigate-petrel; the Madeiran petrel, a large edition of the British storm-petrel; and the all-black, wedge-tailed Bulwer's petrel, the most silent of the five species. Only the great shearwater is strong and fierce enough to be able to abandon the natural nocturnal rule of the petrel family. The shearwaters are much hunted for their flesh and oil; the other chief birds which the local inhabitants kill for food are the woodcock, red partridge, quail, snipe, and bustard.

Reptiles. Snakes are not found on any of the islands, and there is only one species of lizard in the Azores and one in the Madeira group. The lizard breeding in Madeira varies from 2 to about 7 inches in length and is usually brown in colour, though sometimes gray or black or greenish-blue. It infests the island in immense numbers and, though it abates the mosquito and house-fly nuisance, it is a pest to the vine-tenders, as it often causes great havoc in the vineyards by devouring the ripened grapes. On the less frequented islands such as the Desertas, the lizards show a remarkable boldness and will nibble the fingers and toes of seated persons and run forward to grab the food out of a man's hand.

More than a dozen species of lizards live in the Canaries and all belong to the Mediterranean or north African fauna except three, one of which is common throughout the archipelago, another occurs only in Lanzarote, and the third only on the Rocas Salmona off Hierro. The male of the Hierro species attains $21\frac{1}{2}$ inches and the female $17\frac{1}{4}$ inches.

The loggerhead turtle is found off the coast of Madeira but does not breed there; considerable numbers are captured and made into soup.

Frogs and Fresh-water Fishes. Two species of frogs have been introduced into all the island-groups, the one being a small, green water-frog and the other a tree-frog that often may be heard croaking in the evening. Of fresh-water fishes, the only kind which can be regarded as indigenous is the eel; even where permanent lakes and streams occur there have been no great attempts to stock them with foreign species, except some of the crater-lakes in S. Miguel.

Insects. The insect-life of the three archipelagos exhibits a large proportion of peculiar genera and a great many indigenous species. The Coleoptera (beetles), totalling well over 1,800 species, may be justly considered as typical of the insect-life as a whole. In the Azores the proportion of peculiar types (about 10 per cent.) and of Atlantic species is smaller than in the other two island-groups, while that of living European forms is much greater. This somewhat anomalous state of affairs may perhaps have arisen because the Azores, being situated in stormier latitudes, receives waifs and strays more frequently than do the two other archipelagos. In the Madeira group nearly 700 species of beetles have been recognized (or over double those of the Azores), and in the Canaries over 900 species. In both of these groups the proportion of endemic forms is very large, and a great many of all kinds are either wingless or have such poorly developed wings that they cannot fly. Nearly every separate island adds some distinct species or marked variety to the general list.

The other types of insect occur in much the same proportions as the beetles, there being, for example, 250 Diptera (two-winged insects such as gnats, and house-flies) in Madeira and 550 in the Canaries. The chief insects that are likely to annoy man are the house-fly, the mosquito, the ant, and the flea. The mosquito is sometimes troublesome in the Canaries, while the stinging ant is found in all the islands. In Madeira, where the ant swarms into the houses, the Argentine variety did not become a real nuisance till towards the close of the last century; although small, it attacks in such numbers that it can easily destroy large fledgeling-birds and carry off food wholesale from larders and houses, into which it penetrates with great determination.

Arachnida. Spiders are common on all the island-groups, the largest in Madeira reaching a length of 1 to 2 inches. The biggest species, of the tarantula type, rarely go into dwellings.

Molluscs. The land and fresh-water snails recorded from the various islands are mainly of zoological interest. About 70 terrestrial species have been found in the Azores; half of these being peculiar to the archipelago. The total species of land snails collected so far in the Madeira group is about 160, of which 70 are peculiar to the main island and another 40 to Porto Santo. Complete details of this and many other branches of the fauna of the Canaries have not yet been recorded.

CHAPTER V

HISTORY

IT was not until the fifteenth century that efforts were made by Europeans to rediscover and colonize the Atlantic islands. All the islands may have been discovered before that century, and the existence of the Canaries was certainly well known in Europe; but such knowledge was merged into and confused with ancient and medieval legends concerning the Atlantic, and particularly with Plato's fable of Atlantis, the powerful country which had disappeared beneath the sea, leaving in its place 'only a sand bar which stops navigators and renders the sea impassable'.

After the establishment of colonies in the archipelagos, it is interesting to notice the effects of geographical environment on their development. The most powerful factors appear to have been their isolated position and small size, though the fertility of volcanic soil and the benignity of climate also played a considerable part. Their oceanic position assured their development as Atlantic bases, at first for shipping, and in recent years for air traffic. It also caused them to be constantly harassed by enemy raids from Moorish, English, Dutch, and French fleets, till the end of the eighteenth century. In the Azores the distance from Portugal undoubtedly helped to foster the two revolts against the central authority at Lisbon. The small size of the islands, however, served to lessen the strength of such struggles for independence. Owing to the restricted land available, the population soon became too large for the resources, and even in the early days of colonization elaborate irrigation and terracing systems were built to extract a large yield from the soil. Later very large numbers of emigrants have left for the Americas. Another characteristic feature of the development of small islands, the concentration on special crops for export, is also noticeable in the history of the Atlantic islands. The sugar crop of the early colonies has been replaced by the wines of Madeira, the pine-apples of S. Miguel, and the tomatoes and bananas of the Canaries. The dangers of such monocultures, all of them producing non-essential goods, are obvious.

THE CANARIES

The early history of the Canaries is fundamentally different from that of Madeira and the Azores in two ways: first, because the islands,

though sometimes a little confused with mythology, were always known in parts of Europe, owing to their proximity to the African coast; and secondly, because they were inhabited by a hardy warlike people who prolonged the European attempts at conquest for nearly a century.

Discovery and Early Expeditions

Probably the Phoenicians were the first civilized people to discover the Canaries, but owing to their custom of keeping knowledge of new territories secret in order to preserve their trade, little is known of their visits. Undoubtedly, the quantities of orchilla, a moss which produces a purple dye much prized by all the early discoverers, would attract the Phoenicians especially to Lanzarote and Fuerteventura, the islands nearest to the shelter of the mainland. A second possible expedition is that by Sesostris, King of Egypt, to islands beyond the strait of Gibraltar where 'the souls of heroes drifted', mentioned by Homer as taking place in roughly 1400 B.C. This is perhaps corroborated by the otherwise curious knowledge possessed by natives of the Canaries of the art of mummifying. A third probable visitor was Hanno, one of the most daring of the Carthaginian explorers, who gives descriptions of volcanoes which he cannot have seen elsewhere.

Later, recognizable descriptions of the islands began to appear, including those by Pliny and Plutarch, who took their information from a King Juba of Mauritania. Juba had sent explorers there who collected some of the most typical products, and later erected factories, probably on Lanzarote, for collecting orchilla moss. In A.D. 150 Ptolemy defined their geographical position remarkably accurately and based his meridian line through the island of Hierro, then the western edge of the known world. It is interesting that scientists called to a conference by Cardinal Richelieu in 1634 again proposed to use Hierro as the initial meridian. The use of this meridian was almost universal until the beginning of the nineteenth century.

After the ideas of the Roman cosmographers had been lost the Canaries became almost mythological. They were known as the Fortunate Islands, the lands of eternal spring, carpeted with golden flowers, where lay the garden of the Hesperides, guarded by a dragon, this undoubtedly being a reference to the red blood-like gum of the dragon tree. Then, too, altars stood here to uphold the heavens, the tapering cone of the Pico de Teide, often shrouded in mists, suggesting a pillar for the sky, whilst such exploits as those of Hercules were sited

in the mysterious isles. To these classical myths were added Christian legends such as those of the islands of the Anchorites, of St. Brandan, an Irish monk who, sailing fifteen days west, 'saw the mighty intolerable ocean on every side, and then beheld the beautiful noble island with trains of angels rising from it', of the Isle of the Seven Cities, and many others. Doubtless several of these stories were the results of unpremeditated voyages to one or other of the north Atlantic islands, probably to the Canaries as they were the easiest to reach during the days of coastal navigation.

Whilst European sailors were still afraid to pass the shallows of Atlantis, the Arabians gained definite knowledge of the Canaries and, in A.D. 999, landed and traded at Gando bay in Gran Canaria. This harbour was usually visited by the early traders and was later the site of several Spanish forts. The Arabs, according to their famous geographer, Edrisi, also visited the other islands, giving them corrupted forms of the names used by Ptolemy.

Visits by Genoese, Majorcan, Portuguese, and French navigators, particularly to the eastern islands, became increasingly frequent during the thirteenth and fourteenth centuries. Owing to the disturbed state of Europe, it is probable, however, that these voyages were not at first widely publicized. Amongst the travellers was Lanzarote Malocello, a Genoese of Norman origin, who probably gave his name to Lanzarote and is said to have landed, traded, and built a wooden fort on the island. In 1291 it is thought that the unfortunate brothers Vivaldi followed him, and in 1341 an organized expedition led by Niccoloso da Recco and Angiolino de Corbizzi gave a full description of the islands and returned with four natives and various products. This voyage resulted three years later in the first of the grants which later became so familiar in the history of the Canaries; the Pope, who had the right to dispose of newly discovered territories, giving the Fortunate Islands to D. Luis de la Cerda, a Castilian noble. An indignant protest was then made by the English ambassador, who thought that by the 'Fortunate' isles only Great Britain could be meant. Little came of the grant, though an expedition may possibly have set out for the Canaries in the following year; if so, it had no new results. Yet these voyagers, although they returned without any great wealth, were collecting a sufficient supply of dragon's blood (which was much prized for its medicinal uses), orchilla moss, hides, fish oil, and tanning bark to make the journeys at least worth while. This was but the preliminary nibbling at the resources of a country which eventually leads to occupation.

Bethencourt's Expeditions

When in 1402 Jean de Bethencourt, Lord of Granville in Normandy, and Gadifer de la Salle collected together a body of adventurers and set out from La Rochelle 'to see and explore all the country with the view of conquering the islands and bringing the people to the Christian faith', a new and unhappy phase for the Canaries began.

The expedition arrived in Lanzarote in July, a fort called Rubicón was built, and the island was soon occupied. The people, however, could only be captured with difficulty, owing to their habit of hiding in caves. An unsuccessful expedition was made to Fuerteventura, before Bethencourt returned for fresh men and provisions, leaving Gadifer in charge of the island. In his absence, rival factions, mutiny, and treachery were rife; the subjection of the natives, however, continued, so that those that were not killed 'were reduced to such an extremity that they knew no longer what to do, but came from day to day to throw themselves upon their mercy, so that hardly any who remained alive were unbaptised'. Gadifer also made a survey of the other islands of the group, the crew being enticed by the possible gain of 'skins, fat, orchilla weed, dates, dragon's blood and many other things which would bring them great profit in Castile'. Some trade was done with the natives of Grand Canary in exchange for 'fishing hooks, old iron and little knives'. It is not surprising therefore that when Bethencourt shortly afterwards returned, having done homage for the islands to Henry III of Castile with no reference to Gadifer, the two leaders quarrelled. Gadifer eventually returned to France, leaving Bethencourt in charge, but his resourcefulness had undoubtedly ensured a firm foothold in the islands, from which Bethencourt soon profited.

The conquest of Lanzarote and Fuerteventura was rapidly completed, the people being baptized, and many of them taken as slaves. Bethencourt then fetched colonists from his estates in Normandy 'amongst them all sorts of handicraftsmen', and took them to Lanzarote, where the country 'fulfilled their expectations and pleased them more the more they looked at it'. As he had these new settlers to provide for and as not all of them could have suitable land in Lanzarote and Fuerteventura, Bethencourt made a strong attack on Gomera. He was easily repulsed, and continued to Hierro. Here the natives, owing to the depredations of slave-traders, were much reduced in numbers, a process which Bethencourt himself completed. He then placed in the island 'a hundred and twenty households', mainly of those 'best acquainted with agriculture'.

Having settled the early problems of the colony, Bethencourt left the islands in charge of his nephew, Maciot de Bethencourt, and sailed to Spain in 1406, to obtain a bishop for the inhabitants. He then went back to Normandy, and returned no more to the Canaries. In four years he had conquered and colonized Lanzarote, Fuerteventura, and Hierro, and attacked La Palma, Gomera, and Gran Canaria. His conquests provided an invaluable base of operations against the other more thickly populated and more fertile islands.

Maciot, after an assault on Gomera which eventually proved fruitless, devoted his energies to selling his rights to various purchasers, including Prince Henry the Navigator of Portugal, and several Spanish noblemen. He seemed to take little interest in the Canaries, and later moved to Madeira, after its colonization by the Portuguese.

Portuguese Expeditions

From 1420 to 1479 the Portuguese made a determined effort to establish a base in the Canaries in order to prevent the Spaniards from controlling such a vital point on their trade-route along the west African coast. Prince Henry the Navigator, in pursuance of rights purchased through Maciot and later from other Spaniards, took the usual attitude of his times, that unoccupied islands belonged to those who conquered them, and attempted to subdue Gran Canaria. In 1425 he sent out a very ambitious and expensive expedition under D. Fernando de Castro, equipped with 2,500 men and 120 horses. Owing to the fierce resistance of the natives and the shortage of provisions, this proved unsuccessful. Other attempts by Gonçalves da Câmara in 1427 and by D. Diogo da Silva in 1440 had a similar fate. In 1445 another voyage secured the submission of the chiefs in Gomera, and captives were taken by trickery; these were returned to their homes by Prince Henry, loaded with presents. Later attacks were made in 1450, 1451, and 1453; in 1455 Cadamosto, a Venetian in Henry's service, landed on Gomera and Hierro. He gives a description of the unoccupied islands: 'These three islands', that is, Tenerife, Gran Canaria, and La Palma, 'being populous have many men to defend them, are very mountainous with dangerous, fortified places, and have never been reduced by the Christians.' He describes also the customs of the inhabitants and the products of the islands, which included orchilla weed, goatskins 'large and of good quality, some tallow and good cheese'. The Spaniards, however, greatly resented the Portuguese intrusion in the islands and they destroyed a force landed by the Portuguese in Gran Canaria in 1477. Two years

later the treaties of Alcaçovas and Toledo confirmed the Spanish claims to both the conquered and the unconquered islands, and the Portuguese thereafter turned their attention to their rapidly growing African Empire.

Spanish Conquest

During the Portuguese attempts to conquer Gran Canaria the Spaniards had also kept up sporadic attacks. They made little progress owing to the mountainous nature of the country, the agility of the natives, and dissensions amongst their leaders. However, they were coming increasingly to depend on native auxiliaries from the other islands, who, knowing something of the customs of the inhabitants and having the same physical prowess, became indispensable allies. A wasting melancholia, the *modorra*, which severely affected the native forces in Tenerife, also helped the Spanish conquest of that island, which otherwise might have been much prolonged.

The small island of Gomera was usually the base of operations against the other islands; it had been granted to the Herrera family, and provided very loyal native auxiliaries. In 1464 Diego de Herrera went thence to the site of Santa Cruz in Tenerife, made terms with the native chiefs and gained permission to erect a tower, which was later destroyed. He also made two attacks on Gran Canaria in that year, and in 1466 was allowed to erect a fort at Gando bay. Juan Rejón was officially sent out to continue the fight in Gran Canaria, and in 1478 a secure foothold was obtained in the north-east. Continued battles, some of them very costly to the Spaniards, broke the back of the opposition, and in 1483 Pedro de Vera induced the remnant of the native forces to surrender. They then included only about 600 warriors, though Cadamosto had estimated the population at 8,000 to 9,000 persons in 1455.

The subjugation of La Palma and Tenerife was the work of Fernando de Lugo, a Galician noble who had been granted the valley of Agaete in Gran Canaria for his services and had decided to conquer the remaining islands. He secured the title of 'Captain-General of the conquests in the Canaries' from the Spanish court, and in 1491 attacked La Palma. Although this island is so small, and was said by Cadamosto to have very few inhabitants, the conquest even with the aid of auxiliaries from Gomera took seven months.

Lugo landed in the neighbourhood of Santa Cruz in Tenerife on 1 May, 1493, with an army of between 800 and 1,000 men, including 150 cavalry. He marched first into the hinterland where La Laguna

now stands, and there enticed four of the native kings to join him. From them he learnt of the position and strength of Bencomo, his most formidable opponent. Daily forays were made which much reduced the strength of both sides, but the Spaniards managed gradually to advance to the valley of Oratava. Here, however, they were caught in an ambush in which about 600 men were killed and Lugo was forced to retreat to Gran Canaria. Reinforced by fresh levies, he returned to the island but was unable to gain a foothold and almost immediately re-embarked. On 23 November 1495 he successfully landed with about 1,200 men, and gradually advanced to the site of the Realejo villages. Here at last Bencomo, seeing his forces almost annihilated by continual war and disease, surrendered early in 1496.

The settlement of Spaniards in the conquered islands had meanwhile been going on apace. European crops were introduced, and towns were growing up. The remnants of the native peoples were not exterminated but gradually became absorbed by the conquerors; later it became a source of pride to be able to prove a native ancestry. Though the immigrants were mainly Spanish, a number of Flemish refugees settled in La Palma, escaping from the tyranny of the Duke of Alba. It was due to their knowledge that later the silk trade was highly developed in that island, the products being noted for their strength and brilliancy. The English never frequented the Canaries as they did Madeira, but by 1533 factors representing London merchants were established in Gran Canaria.

Spanish Rule

Columbus called at Gomera before setting out on his first voyage to the Indies; he took in provisions at San Sebastián and left on 7 September 1492. The cavalry horses used in the conquest of Tenerife were afterwards sent over to the Americas and formed the stock from which half-wild mustang horses were developed. On his second voyage Columbus also collected other domestic animals at Gomera to import into his new colony. The islands rapidly became an indispensable base on the sea-routes to America, particularly as they could provide abundant water and supplies. In this way, a close connexion early grew up between the West Indies and the Canaries, and the treasure fleets used normally to refit here, before proceeding to Cádiz and Seville.

The position of the islands made them very exposed to attacks from enemy pirate fleets in the constant wars in which Spain was involved. The earliest of these attacks were made by the Moors on

Lanzarote and Fuerteventura in 1569 and 1586, raids which resulted for a time in the occupation of Lanzarote. These were the outcome of disputes over ownership. The Moorish attacks continued sporadically up to 1749. The islands were naturally the prey of English fleets, though these were often more a potential than an actual danger. In 1595 Sir Francis Drake and Sir John Hawkins visited Gran Canaria and Gomera without doing much damage; in the following year the Earl of Cumberland landed on Lanzarote looking for gold worth £100,000 which was reputed to be hidden there; he secured instead quantities of wine and cheese. In 1656 Admiral Blake, commanding a fleet of 36 vessels, had more success in destroying galleons lying at Santa Cruz de Tenerife, which were bringing gold from Mexico. He played great havoc in the harbour and destroyed about 16 of the treasure ships; he was presented by Cromwell with a valuable diamond for his deeds. The next visit of a British fleet was that of Admiral Jennings in 1706, who again forced his way into Santa Cruz. At this time the islands were supporting the rights of Philip V against those of Archduke Charles of Austria in the War of the Spanish Succession, and the English fleet was sent to demand from them a change of allegiance. The reply was adamant, the Governor Antonio de Ajala sending this message: 'Tell the Admiral that if Philip had lost the whole of the Peninsula, the Islands would still remain faithful to him!' At this the English fleet left the islands without disembarking. In 1743 another attack was made by Admiral Charles Winton on La Palma, Gomera, and Gran Canaria, but with little success.

Nelson in Tenerife

By far the most famous of these affrays was the attack by Nelson on Santa Cruz de Tenerife in July 1797. This short battle won great fame because it was Nelson's only reverse, and it was on this occasion that he lost his right arm.

Nelson went to Santa Cruz with four ships of the line and three frigates, under orders to capture treasure which had just been landed there from a Spanish ship. On arrival, the surrender of the treasure was demanded, but was not obtained. The ships anchored in the bay, known as the Valle del Bufadero, about 1 mile north of the town. At midnight on the 24th the main attack was launched on the mole of Santa Cruz. Owing to the darkness of the night, many of the boats missed the mole and were either dashed to pieces on the heavy surf or went ashore to the south of the town. The Spaniards also discovered them and the cutter and several other boats were sunk by

shore guns. Nelson himself was wounded by a cannon ball in his right elbow, and had to return to his ship, where in the darkness and turmoil his arm was clumsily amputated. The remainder of the boats continued and took the mole, but when an attempt was made to enter the town, fierce fire opened up from the fort of San Cristóbal and the men were forced to retreat. Meanwhile Captain Troubridge, who commanded the boats which beached in the south, had landed successfully and taken the Dominican convent as his headquarters. Unable to join the men on the mole, he made terms with the Spaniards and was allowed to purchase provisions. The atmosphere of the scene immediately changed to one of cordiality; Nelson and the governor exchanged compliments and presents, and the men still on shore were presented by the Spaniards with bread and wine. The loss of men on the British side was heavy, about 250 men being drowned, killed, and wounded. For its part in this encounter Santa Cruz was in 1821 made the capital of the islands.

Recent History

Since these stormy interludes the Canaries have been concerned mainly with agricultural changes, and with the growth in importance of their position on the sea-routes of the Atlantic. Their agricultural policy became increasingly connected with overseas markets, particularly that of Great Britain, first for cochineal and later for potatoes, bananas, and tomatoes. Las Palmas and Santa Cruz de Tenerife gradually improved their roadsteads to accommodate ocean traffic, and became important coaling stations. In 1833–1834 submarine cables were laid linking the islands with Europe and America. In common with the other Atlantic islands, the Canaries also developed a valuable tourist trade, owing to the healthiness of their climate and the attraction of their scenery.

MADEIRA

Discovery

Amongst the confused tangle of evidence about the first discoverers, two of the early claims have some support. First, there is the Genoese claim based on a portolan chart of 1351, on which the islands are named Isole de la Legname, Porto Santo, and Isole Deserte, names which closely resemble those given to them later by the Portuguese. Secondly, there is the possible voyage of the Englishman, Robert à Machin. His is a romantic story, much embroidered later by various

writers, but it has gained credence because it was first derived from Portuguese sources. This Robert à Machin in Edward III's reign eloped with a certain Anna d'Arfet and, leaving Bristol, arranged to find shelter in France. A gale from the north-east drove them far afield, and after thirteen days at sea they came upon a wooded uninhabited island which could only have been Madeira. They landed here, it is said, in Machico bay, and while exploring the island their boat was lost in a second storm. Unable to bear further misfortune, both Anna and Machin died. The crew contrived to make themselves some craft, in which they reached the coast of Africa, but were there taken as slaves. They gave details of their discovery to a fellow captive, Juan de Morales, who was later ransomed and became pilot to the rediscoverer of Madeira, João Gonçalves Zarco.

The voyages of Zarco surpass in importance these chance visits, because he followed up his discoveries by the settlement and development of the islands. On an expedition to the west coast of Africa, Zarco with Tristão Vaz (Teixeira) was blown by a storm to the island of Porto Santo which they reached on All Saints' Day, probably in 1418. This was the first concrete result of Prince Henry the Navigator's plans to explore the African coastline, and aroused great interest in Lisbon. Zarco, Vaz, and Bartholomeu Perestrello were sent out with colonists and stock. Unfortunately, a doe-rabbit was included which bred so prolifically that cultivation soon became impossible, and Perestrello returned to Portugal. He was persuaded to return and made the Captain-Donatory of the island; his daughter afterwards married Columbus, who is supposed to have gained much information from Perestrello's papers.

The early colonists in Porto Santo could, when atmospheric conditions were favourable, look across the 23-mile strait to Madeira, which appeared as a low black cloud on the horizon. This they watched with much trepidation, thinking it to be the mouth of hell. Zarco and Vaz, returning from Lisbon, determined to explore the phenomenon. As they approached, the smoke that had seemed to be pouring out of hell resolved itself into forest vapour, and a lofty wooded island was gradually revealed. The explorers first touched at Ponta de São Lourenço, the long north-eastern projection of Madeira, and thence sailed westwards. According to some authorities they next discovered the graves of the Machin expedition in Machico bay, which they named to their memory and erected a chapel there. They continued past Ponta do Garajão, called Gralhos by Zarco because of the numbers of tern that flew out to them disturbed by

their intrusion, and made a general landing in Funchal bay, where the islets gave them shelter. One of the explorers made a short journey through the dense woods and, climbing a hill, gained an outline view of the island and confirmed its uninhabited nature. Zarco followed along the coast westward to a small cove, which he named Câmara de Lobos, because he disturbed there a troop of seals, and then returned to Portugal with various products from his new discovery.

Settlement

The settlement of the Madeira group followed very soon after its discovery, for Portugal under the inspiration of Prince Henry the Navigator was keyed up for expansion.

After early disappointments, colonists soon became well established on Porto Santo, though their numbers never greatly exceeded 2,000. On his visit to the islands in 1455 Cadamosto describes Porto Santo as producing corn and barley for its wants and abounding in cattle and wild pigs, but still troubled by innumerable rabbits. Probably the most valuable product was dragon's blood, the gum which was collected from the dragon-tree as in the Canaries. Cadamosto also mentions the prolific fishing-grounds near by, which were exploited for local needs.

There is no record of the actual discovery of the small Desertas islands, but they are clearly visible from Madeira. In 1430 Zarco sent cattle to the islands to use their good grazing land, but owing to the lack of fresh water no settlement was possible, and the islands were therefore named 'the deserted'. The first owner of the islands was a certain Luiz Gonçalves de Ataíde. Fructuoso, writing in 1590, reported that wheat and rye was sown, 'but not in large quantities as most of the land is retained for pasture. Eight men and a factor live there.' A number of outlaws under one Penteado who, in 1503, tried to raid the island for cattle had been firmly repulsed by the herdsmen, who rolled an avalanche of boulders upon the invaders. The islands never became of greater value, and in 1803 a series of waterspouts washed the grazing-land away. They were then abandoned and to-day only fishermen make regular use of their coves.

Madeira was divided into two captaincies which were granted to Zarco and Vaz. The new governors collected a motley crew of adventurers, freed slaves and fugitives, and founded their first settlements at Funchal and Machico. As the wealth of the colony became evident, Zarco persuaded some of the noble families and merchants to emigrate, so that the balance of normal Portuguese

society was restored. Soon the population became too large for the resources available, and, after the conquests in America, Madeira sent many emigrants to Brazil.

The first task of the colonists was to clear the land for cultivation, a task which, owing to the mountainous configuration, thick cover of giant trees, and dense undergrowth, was almost impossible by hand. Zarco therefore ordered the trees to be fired, and so great a conflagration followed that it was said to have lasted for seven years and to have been so fierce that the people at one time were forced to 'take refuge in the sea, where they remained without food or drink for two days and two nights'. The forests were also attacked for timber, saw-mills being erected on the streams, and the wood being used not only in Madeira but also in Portugal, where it notably improved the domestic architecture of that age.

As the slopes were cleared, more profitable crops were introduced. The staple of the early prosperity of the island was the sugar-cane, introduced by Prince Henry the Navigator from Sicily, and tried out very successfully at Machico. In 1452 a water-mill was set up for the extraction of sugar, and soon afterwards Madeiran sugar began to compete in the European markets, greatly lowering its price there. In 1498 King Manuel limited the quantity allowed to be exported and allotted it on a quota system to the chief purchasers, which were then Flanders, Venice, Chios, Constantinople, Genoa, and England. A second crop brought to the island by Prince Henry was the Malvoisie grape from Crete, the stock from which the famous Madeiran wines were later produced. Cadamosto speaks of them as flourishing 'very well in the rich, good soil, bearing almost more fruit than leaves. The bunches are very large—the finest sight in the world.' The first recorded export was to Francis I of France in 1575. Altogether, the early settlement gave an impression of 'a most fruitful and well stocked land', and new villages began to grow up along the south coast. It was not, however, until much later that the more rugged northern coast was peopled, and probably some of the travellers who continued to report the finding of uninhabited islands in the Atlantic were in fact simply touching upon this coast.

In 1461 the large landowners began to construct an extensive series of irrigation channels (*levadas*); these ensured that all available land could once again be used, the water-supply having become less regular owing to the destruction of the forests. The system was built with great skill, often along the edges of precipitous ravines, and came into general use in 1515.

By the beginning of the sixteenth century the colony in Madeira was well established and rapidly becoming rich from the double advantages of slave labour and virgin soil. Increasing wealth was already alienating many landowners from their estates and there was a general move to Funchal, where fine houses were built and magnificent state maintained. The governorship at this time had become almost an hereditary possession of the Zarco family, Zarco himself ruling the colony for forty years. As a result of its importance, Funchal was formally made a city in 1508, and was soon afterwards granted a bishopric.

The position of Madeira as a base on the sea-route to India brought to it an increasing number of trading, official, and pirate vessels. As early as 1446 a Portuguese chronicler, Zurara, observed that 'it was already the accustomed thing for all the ships that were sent out when they left this realm to go first of all to the island of Madeira to take in their victuals'. As in the other Atlantic islands, this constant traffic attracted semi-official pirates from other countries, who on many occasions raided the island. One of the most severe of these raids took place in 1566, when three French galleons under Pierre de Montluc disembarked about 900 men near Funchal. Owing to the lack of organization under a vacillating governor, the town put up no adequate defence. The raiders looted every movable object, and slew such of the defenders as they could find. An avenging Portuguese fleet did not catch the buccaneers, but Montluc himself died of a slight wound received in the action.

The island, in common with Portugal, was under Spanish administration from 1580 to 1640. There seems to have been no opposition to the Spaniards comparable to that in the Azores, and the quiet agricultural life continued.

British Relations with Madeira

Soon after the departure of the Spaniards the number of British residents greatly increased. At one stage in the marriage negotiations between Catharine of Bragança and Charles II of England Madeira nearly became a British colony, but a considerable money dowry was eventually substituted. Favourable terms and privileges in Madeira were, however, also granted, and undoubtedly encouraged English settlers already attracted to the islands by the trading opportunities and fine climate.

A British consul had been appointed in Madeira in 1658, and soon afterwards a British 'factory' or trading station was founded similar

to those established in India at the same period. This was a corporate body which dealt with all matters affecting British merchants, and was principally concerned with the export of Madeira wines. The factory in fact was the 'Parliament' of this trade and had the privilege of levying duties upon all British imports and exports connected with Madeira. Though principally concerned with the British colony, which included, after the Scottish rebellions of 1715 and 1745, many refugee Scotsmen, its activities benefited the whole island, as it did much to improve roads, build levadas, and stimulate trade. A handsome supplement was also paid annually to the Governor's salary; in return for this subsidy, which was not discontinued till 1835, the factory nominated several Portuguese officials. Its heyday was at the end of the eighteenth and beginning of the nineteenth century, when, owing to the wars with France, there was little competition in the British markets for the Madeiran types of wine. It is said that the taste for the wine was first acquired by officers returning via Madeira from the American War of Independence.

For two periods in the Napoleonic wars the islands were temporarily under British protection; first in 1801-1802, when the occupation was submitted to with great goodwill, and secondly from 1807-1814, after Junot had entered Lisbon, when Major-General Hugh Mackay governed the island under a strict military régime.

With the growth of national feeling in the nineteenth century, the power of the factory and the almost complete monopoly of the trade of the island in the hands of British merchants were much resented locally. Gradually the factory declined in importance, its philanthropic functions being kept up by occasional meetings of the chief British residents. There was, however, no corresponding decrease in the British colony in the island; to it were due many of the luxury hotels, which were visited by a flock of British invalids and tourists. It was an Englishwoman also who introduced the art of embroidery into the islands, in order to utilize the surplus female labour and provide an acceptable product for overseas markets. A recent connexion between the two countries was the refuge given by Madeira to evacuees from Malta and Gibraltar from 1939-1944.

Recent History

The history of Madeira during the eighteenth and nineteenth centuries is closely linked with that of Portugal. After the loss of Brazil, the resources of the island were increasingly used to help balance the home country's budget. The prosperity of the island was

adversely affected by the law passed in 1775 forbidding the slave trade. The wine and sugar plantations had depended on slave labour for all heavy manual work, and the numbers of slaves had amazed Captain Cook on his visit to the island in 1768.

As has been shown, the island was closely linked with Britain during the Napoleonic wars. It was also affected by the *coup d'état* in 1828 when Dom Miguel seized the Portuguese throne. Madeira, with the Azores, remained loyal to the wishes of the Emperor Pedro in Brazil, and a large Miguelite fleet was sent out from Lisbon to overthrow his authority. Great preparations were made at Funchal to resist the invaders, who after some delay landed at Machico bay. The Miguelites overwhelmed the island forces opposing them and proceeded to Funchal. With a swift change of allegiance, the inhabitants were soon lighting a myriad of bonfires in honour of the invaders. Their rule, however, was only temporary, and Pedro regained control in 1832.

With the other Atlantic islands, the position of Madeira has become increasingly valuable. It was made an important cable centre in 1874, and was visited by numerous steamship lines. It has so far proved too mountainous to be of use as an air base. During Portugal's stand with the allies in the War of 1914-1918, Funchal was shelled twice by German submarines, first in December 1916, when a French gunboat, a submarine carrier, and a British cable ship were sunk, and secondly in December 1917 when little damage was done.

THE AZORES

Discovery

As many of the details of the discovery and settlement of the Azores are still confused or unknown, the following version is based on the main probabilities. The islands were first represented in recognizable form on the same Genoese portolan chart of 1351 which also showed Madeira. It seems that a similar map was in the possession of Prince Henry the Navigator, who on this evidence sent out an expedition in 1431, under Cabral, to look for the islands. On the first voyage Cabral found only scattered black rocks surrounded by surf, which he named the Formigas (ants). He returned again in the following year and on 15 August reached S. Maria. Colonization was started at once; Cabral was given the rank of Captain-Donatory, and allowed to collect settlers, some of noble birth, and various types of livestock from Portugal.

It is somewhat surprising that none of the other islands was discovered for some years. There is a tradition that a slave escaped from the S. Maria settlers, and, climbing a hill in the north of the island, saw in the far distance the outline of a second island, S. Miguel, which is about 50 miles to the north. On this information Prince Henry sent Cabral out in search of it, and after one unsuccessful voyage he reached it, probably in 1444.

There is no exact information about the discovery of the other islands. Apparently Terceira was sighted by sailors returning from Cape Verde to Portugal between 1445 and 1450, and was first named the Island of Jesus Christ. This was later changed to Terceira or 'the third' island. From here the islands of the central group are visible one from another, and record has only been kept of their colonization.

Of the two small outlying islands, Corvo and Flores, which were long called the Western Islands, we only know that they were discovered before 1460. It was on Corvo that there was said to have been found the bronze statue of a man on horseback, his right arm pointing to the west and with unknown characters etched in the rock at his feet, which is supposed to have inspired Columbus to take his westward course towards Amercia. This statue was thought to have been the work of the Phoenicians, for a vase of coins washed out by heavy surf during a storm in 1749 was also identified as of Phoenician origin. Many authorities, however, do not accept this evidence and point out that a north-western promontory of Corvo presents the shape of a person with an outstretched arm, and so probably was the foundation of the legend.

At the time of the Portuguese rediscovery the islands were completely uninhabited and had no vertebrate animals. Being 800 miles away from Portugal, their discovery showed great skill and courage in the first navigators; the distance had prevented any stray visits from African peoples. The explorers were impressed by the great number of buzzards wheeling over the islands, and mistaking them for hawks, gave the group their present name of 'Açores'. Dense woods of tall 'cedar' trees covered the islands, but were quickly cleared and used for the building of the first villages.

Settlement

The Portuguese were assisted in the work of colonization by Flemings, who were at first so numerous in the central islands that the title of 'Flemish Isles' was given to them for several centuries.

On his voyage of rediscovery in 1444, Cabral had landed on the

south-eastern shore of S. Miguel, at a place which he named Povoação. This he found to be well sheltered, with several streams nearby; he accordingly left some African slaves to clear the land and make it suitable for cultivation. After reconnoitring the rest of the island, and deciding on the places most suitable for settlements, Cabral returned to Portugal. His news of the fertility and size of the island attracted a number of colonists, who collected seeds, plants, tools, and domestic animals and arrived in the island on 29 September 1445. The African slaves were found to be in a state of terror, owing to a severe eruption in the western hills of the Caldeira das Sete Cidades; they had only remained because no boat had been left with them. It was with considerable effort that Cabral then persuaded his European settlers to stay, but the fertility of the land, with its promise of several crops a year, proved a sufficient inducement. The towns of Ponta Delgada and Vila Franca were founded, the latter being at first the capital. It was, however, nearly destroyed by earthquakes in 1522 and 1591. Sugar-cane, imported from Candia and Cyprus, soon became the staple export of the early colony, as it was in Madeira. The sweet orange was introduced in 1524, and the China or 'Mandarin' orange was brought from Goa in 1635. The oranges were particularly fine and many were exported. The population of the island rapidly increased, and by 1580 there were already 19,900 inhabitants. There is a tradition that a number of Breton immigrants settled on the north-west coast and founded the village of Bretanha, but no trace of such a colony remains.

The central group of islands came strongly under Flemish influence. Josua van der Berge, a Fleming from Bruges, was closely connected with the Portuguese court, and in March 1450 applied to Prince Henry the Navigator for permission to colonize Terceira. Prince Henry made him the Captain-Donatory of the island, probably because, though a Fleming, he was a Roman Catholic, had married a Portuguese noblewoman, and was prepared to finance the enterprise.

Van der Berge was soon joined by a Portuguese emigrant, Vasco Gil Sodré, who was greatly impressed by the success of the Terceira colony. He gained permission to colonize the fertile island of Graciosa, which had therefore from the beginning a Portuguese population. The first governors of the island were Sodré and his brother-in-law Duarte Barreto, who joined the colony later.

The mountainous island of S. Jorge was colonized by a companion of Van der Berge, William van der Haegen. He brought out two ships from Flanders, laden with emigrants, and founded his first village at

Tôpo, near the eastern end of the island. The country was, however, so difficult to cross, and land so restricted, that Van der Haegen later moved to Fayal. He afterwards tried several of the other islands but eventually returned to Tôpo, and gained great wealth from wheat plantations there.

Meanwhile Fayal had been under the control of a wealthy Fleming, Jobst van Huerter, Lord of Moerkerke and father-in-law of Martin Behaim, maker of the famous globe, which was finished in 1492. On this Behaim writes against the Azores that the islands were given by the King of Portugal to his sister Isabella of Burgundy 'after much solicitation'. It appears, however, that though the Flemings undoubtedly earned special privileges by their colonizing efforts, the archipelago remained under Portuguese rule and was given by Prince Henry the Navigator to his nephew Don Fernando, by a charter of Evora, in 1460. Behaim adds that the Flemings were driven by war and famine to emigrate and that the Duchess of Burgundy sent out Jobst van Huerter with 'a great number of men and women of all classes, with priests and everything requisite for religious worship. She also sent out several vessels laden with materials for the cultivation of the soil and for building houses.'

Jobst van Huerter, after firmly establishing the settlement in Fayal, later obtained the captaincy of the neighbouring island of Pico. The vine did particularly well on the slopes of the conspicuous crater there, and wines were exported to the other islands.

The isolated islands of Flores and Corvo were granted to a Lisbon lady, Maria de Vilhena. It is possible, however, that Corvo was later given to the Duke of Bragança. Van der Haegen is said to have founded villages in the two islands for Maria de Vilhena; but after seven years he returned to S. Jorge, having found them too small and desolate to be profitable.

The Azores had therefore a mixed Flemish and Portuguese population, but the Portuguese language was generally spoken, and though Van Linschoten at the end of the sixteenth century could still distinguish the descendants of the two nations, they rapidly merged into one type.

Owing to the oceanic position of the archipelago, the Azores rapidly became an important base for ships travelling to the Indies, and later to Brazil and Spanish America. Columbus called at S. Maria when returning from his first voyage to America in 1493. Vasco da Gama also visited the Azores in 1499 on his return from India, landing at Terceira with his sick brother Paul da Gama, who died there.

The exposed position of the group made them even more open to attack than Madeira and the Canaries, and in the sixteenth century constant raids were made by Moorish pirates. Many of the towns were therefore heavily walled and fortified, but the raids were often disastrous to the coastal settlements.

Spanish Rule, 1580-1640

The islands, and Terceira in particular, sternly resisted the Spanish efforts at occupation in 1580, when Portugal came under Spanish domination.

Terceira, which has always led resistance in the islands, managed to rout the first Spanish invading force sent by Philip II in 1581. The victory was mainly due to the peasants of S. Sebastião, who collected together a herd of savage cattle and hid them till the Spaniards had completely landed. They then drove them on to the shore where they charged the enemy with complete success. Meanwhile S. Miguel had been occupied by the Spaniards without opposition, and in July 1582 the Portuguese leader D. António, Prior of Crato, backed by a French force, attacked and recovered a great part of the island. There followed a hard-fought naval battle off Vila Franca, from which D. António was forced to retreat to Terceira. In 1583 this island was again attacked by a Spanish force of 13,000 men, and was finally subdued. The island suffered severely in the fight, and was heavily punished by the Marqués de Santa Cruz for its resistance. It was then made the centre of Spanish rule with the port of Angra as capital.

English Raids

When the islands became Spanish territory, and were moreover used as a refuge for treasure-laden galleons, they were subject to constant attacks from English raiders. These fleets, some partly financed by Queen Elizabeth, had the double object of attacking the national enemy and of securing as much of the spoil as possible. English support had in fact been promised to D. António, and in July 1581 a fleet was prepared in Plymouth roads to help him in Terceira. Queen Elizabeth, however, changed her mind and Sir Francis Drake had to disband the fleet.

Over-laden as the Spanish ships usually were, the Azores became an essential port of call, the fort at Angra being the main harbour for them. 'They wait for the fleets that come and go from the Spanish and Portuguese Indies, from Brazil, Cabo Verde, and

Guinea which do commonly come unto Terceira to refresh themselves, as lying very fitly for that purpose; so that all the inhabitants do thereby richly maintain themselves and sell all their wares unto those ships. For the which cause the Englishmen and other strangers keep continually about those Islands.' These are the words of Van Linschoten, a famous Dutch traveller who on his return from India was detained two years in the Azores awaiting transport to Spain. On arrival, his ship was chased by a small English vessel. 'With flags openly displayed they came lustily towards us, sounding their trumpets, and sailed at least three times about us, beating us with musket and calver so that no man durst put forth his head.'

Sir Walter Raleigh was the first of these pirate visitors, arriving in the Azores in 1586 with the two ships *Serpent* and *Mary Sparke*, and taking many prisoners and valuable prizes. After the depletion of the Spanish fleets by the Armada, the Earl of Cumberland, Frobisher, and Hawkins all joined in the attacks from 1589-1591. The Earl of Cumberland set out with four small ships and 400 men, and remained in the islands during the summer of 1589. His inroads on the smaller islands were considerable, a task made easier by the antagonism to the Spaniards amongst some of the Portuguese inhabitants. In Graciosa the people gave him food and wine willingly and thanked him for his courteous behaviour, and he landed without difficulty in Fayal. The main refuges for the English, however, were in the isolated western islands of Corvo and Flores which, as Linschoten points out, were too small to resist any invaders and so 'sailed with every wind'. In the summer of 1590 first Frobisher and later Hawkins ranged the islands, causing great alarm there and in Spain, where they 'cursed those that had been the cause to provoke the Englishmen to fight'.

The Fight of the Revenge

As we have seen, the English carried out their raids with almost complete impunity, their speed and skill giving them mastery over the clumsy Spanish galleons. When therefore Lord Thomas Howard and Sir Richard Grenville were preparing for a large-scale attack on the West Indian treasure fleet in the summer of 1591, they assumed that the Spanish opposition would be very small. In fact, however, the Spaniards, desperate at their continual losses, had built up a considerable fleet, which under Admiral de Bazán was to be used as a convoy escort from the Azores to Spain. As an additional precaution, the treasure fleets were brought over late in the year to wear out the supplies and health of the watching Englishmen.

The English fleet, with Howard as Admiral and Grenville as Vice-Admiral, left England in March. It consisted of the *Defiance*, Howard's flagship, the *Revenge*, two other ships of about 500 tons, and several smaller vessels. It remained, despite several changes, of roughly the same strength throughout the summer. For some months the ships cruised between Cape St. Vincent and the Azores, but found so few prizes on the way that they arrived in the islands 'like lions that have been almost famished for want of prey'. The inevitable consequences of a long sea voyage in Elizabethan times began to be felt; the ships became foul, the men fell sick of scurvy, the reserves of food and water became low, and the armed merchantmen expected as reinforcements failed to arrive. Therefore, though the treasure fleets were daily expected, Howard was forced to land on Flores at the end of August.

Meanwhile the Spanish treasure ships had left Havana at the end of July with 73 vessels of various types, and were now drawing near the Azores, whilst Bazán had arrived in Terceira with an escort of 55 ships, 20 of them fighting vessels, and 7,000 men. Bazán, learning the position and activities of the enemy, decided to attack at once whilst the English were expecting the treasure fleets from the west, with no thought of protection coming for it from the east. After beating about in the channel between S. Jorge and Graciosa for several days, Bazán at length gained a fair wind and drew near Flores. He intended to divide his fleet and surround the island, but a broken bowsprit on one of his leading vessels made him change course, and the whole formidable fleet approached on the eastern or windward side of the island (Fig. 12).

The English, who had very short notice of the arrival of Bazán, were making feverish preparations for departure. Their exact position on the island has always been in doubt, but some Spanish sources state that they were on the west side of Flores, probably in the north-west, while other authorities suggest the north-east (1 on Fig. 12). The best landing-place on the western coast is on a beach in the shelter of Baixo Raza islet, at the northern end of the bay called Olho do Cão (2 on Fig. 12). Here might be found a good anchorage with depths of 25 to 30 fathoms of water, and off-shore winds; water could be obtained from a mountain stream which empties in the bay, and supplies of cattle, poultry, and eggs would be plentiful; and it was here possibly that they had disembarked, when the alarm threw them into confusion. 'Many of our ship's company were on shore, some providing ballast for their ships, others filling of water

Treasure fleets
approaching from West Indies



Howard sails

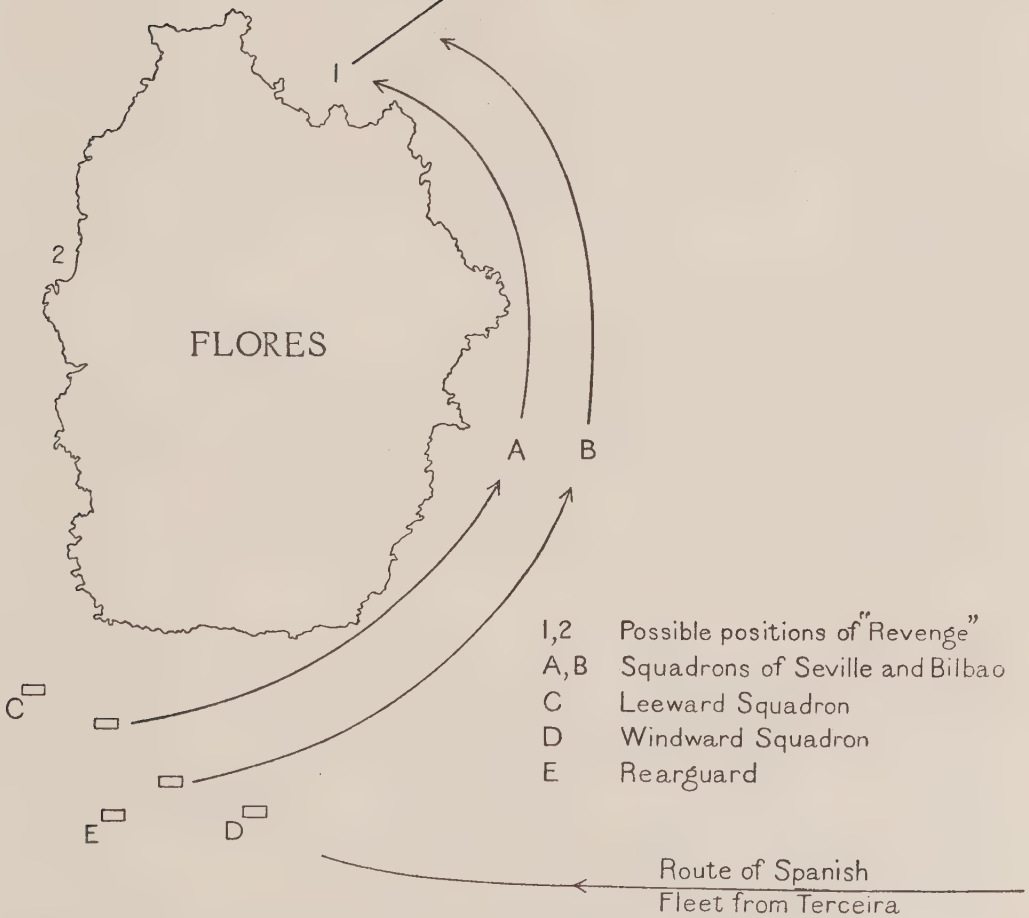


FIG. 12. Probable movement of fleets before the fight of the Revenge, 1591

and refreshing themselves from the land, the one-half of the men of every ship, sick and utterly unserviceable.' So little warning had been given that they 'had scarce time to weigh their anchors, but some of them were driven to let slip their cables and set sail'.

The last to leave the island was Sir Richard Grenville, the rest of the fleet following Howard's manœuvre to get to the windward of the tall Spanish vessels. The *Revenge*, too late to follow the others successfully, could obviously have trusted to her fast sailing powers to run before the wind and outstrip the Spaniards, and this course, comments Sir Walter Raleigh, 'had been the better in so great an impossibility of prevailing'. Yet Sir Richard in a truly Elizabethan spirit 'utterly refused to turn from the enemy, alleging that he would rather choose to die than dishonour his self, his country and her Majesty's ship, persuading his company that he would pass through two squadrons in despite of them'. The leading English ships, including Howard's flagship, were now drawing away from the Spaniards, who were firing but were unable to grapple them. One of these tall high-decked boats, the *San Phelipe*, however, caught the *Revenge* as she came 'swaggering up', and becalmed her so that the ship would not answer to the helm.

So the last fight of the *Revenge* began. Whilst the *San Phelipe* was trying unsuccessfully to grapple her, the *San Barnabe* under General Bertendona came up and managed to fix her grappling irons in firmly. The *San Phelipe* then made off, 'utterly misliking her first entertainment'. Fighting began on the decks of the *Revenge*, the Spaniards throwing aboard small parties of trained soldiers, who 'were still repulsed again and again, and at all times beaten back in their own ships or into the sea'. Ship after ship of the Spanish fleet came up and joined in the fight, which continued through the night, so that by morning 'fifteen several Armadoes assailed her'.

With the sunrise, the damage done on both sides became apparent; the Spaniards had two ships unusable, one of which had already sunk, the other going down during the day, whilst many of the remainder were severely mauled; the *Revenge* though still unbeaten was unable to move and was 'marvellous unsavoury, filled with blood and bodies of dead and wounded men'. Amongst the wounded was Sir Richard himself, who was shot in the body and head. The fighting supplies too were at an end, the powder almost gone, the pikes broken, with no protection on the deck for the men, 'nothing being left over head either for flight or defence'. The *Revenge* in fact could scarcely continue the fight, and her only choice lay between a surrender,

which after such a gallant fight could scarcely fail to be honourable, and destroying the ship.

It was characteristic of the Elizabethan gentlemen pirates, to which Sir Richard belonged, that he should take the heroic path and order his gunner to blow up the ship, 'that thereby nothing might remain of glory or victory to the Spaniards'. Many of his men supported him, but the Captain and Master formed an opposite party, arguing that they were not all, like Grenville, mortally wounded, and that in any case the *Revenge* was in so battered a condition that 'she must needs sink'. After some parleying the surrender was made, though Sir Richard remained adamant, and several of the men stole over to the Spanish ships 'fearing Sir Richard's disposition'.

The fight therefore was to the Spaniards, who carried Sir Richard aboard their flagship and divided the rest of the crew as prisoners amongst the fleet. They were apparently well treated, Sir Richard being tended with great courtesy. His wounds, however, were severe and he died within two or three days, the Spaniards wondering at 'his courage and stout heart'.

The sequel of this noble fight was also staged in the Azores. The victorious de Bazán met the treasure fleets from the Indies he was expecting, sadly depleted by the gales, which were particularly severe that year. He therefore set sail with altogether about 140 ships in convoy to Terceira. But a terrific gale blew up, and at least 15 of the escort vessels and about 70 of the treasure fleet were lost, a blow to the Spanish navy which was said to be as great as that of the Armada. It is not surprising that the Spaniards moaned that 'the taking of the *Revenge* was justly revenged upon them', and talked of Sir Richard Grenville as raising 'the devils who loved him and so caused the storm and tempest'. Appropriately enough, the *Revenge* was amongst the ships that were lost, being 'cast away upon a cliff near to the island of Terceira, where it broke into a hundred pieces and sank to the ground'.

Recent History

The Spaniards finally left the islands in 1640, and Portuguese rule was again established. The visits of passing ships, agricultural vicissitudes, and occasional disastrous volcanic eruptions thereafter became the main events. The population increased rapidly and many emigrants went to Brazil, at one time a rich and valuable Portuguese colony. Great progress was made in the construction of roads, quays, and other public works during the ministry of Pombal in the later eighteenth century, but this was not maintained.

Between 1829 and 1831, the Azores, like Madeira, took an active part in resisting the authority of D. Miguel who had seized the throne of Donna Maria II, left to her by her father, the Emperor Pedro of Brazil. D. Miguel sent a strong fleet to subdue the islands, as he did to Madeira, but here with less success. The fleet arrived off the small harbour of Praia in Terceira, whence the inhabitants, showing the same spirit which they had used against the Spanish invaders, drove them off with heavy losses. Other islands in the group were overrun, but the resistance in Terceira enabled the Emperor Pedro to establish a base there, and he then reconquered the others, the most stubborn of which was S. Miguel, which held out in the name of D. Miguel till August 1831. Thence Pedro organized the expedition which finally took Oporto in July 1832, and from there subdued the whole of Portugal. For its part in this episode Angra was granted its present title of Angra do Heroismo, and the archipelago became a province of Portugal.

With a decline in the orange export trade, and a great increase of population, a strong current of emigration flowed to South and North America, averaging from 2,000 to 3,000 people a year before the War of 1914-1918. Many of these 'Americanos' and 'Brazileiros' returned later to their home islands and settled down with the capital they had earned.

The position of the archipelago as a centre for communications and strategic purposes has rapidly increased in value in the last hundred years. The islands soon became a very important centre for transatlantic cables, Horta being the principal base. In the War of 1914-1918 the Azores were much used as a supply depot and coaling station for the Allied fleets. The harbour of Ponta Delgada was particularly important, becoming as already noted, a United States naval base in the later stages of the War of 1914-1918; in 1917-1918 an aerodrome was established near the town. A German submarine bombarded Ponta Delgada, but did little damage. The air and sea-plane bases were greatly developed between the two wars, the first aeroplane to cross the Atlantic landing at Horta on 17 May, and at Ponta Delgada on 20 May 1919. The islands later became a base for the American clipper service, which has been continuously maintained, save that the winter route now lies via Bolama in Portuguese Guinea.

After 1939 the central position of the Azores became increasingly important as the battle of the Atlantic increased in intensity. In May 1941 President Roosevelt and U.S. Congress members referred to

the Azores as outposts of America, remarks which caused some alarm in Portugal. Shortly afterwards, General Carmona, the President of the Republic, visited the islands, and reinforcements of troops were sent there. On 12 October 1943, however, an agreement was announced between Great Britain and Portugal, under which Allied forces were to be allowed the use of naval and air bases in the Azores. This gave the Allies an important safeguard for merchant shipping and additional shelter for aircraft, whilst the Portuguese will undoubtedly gain at the end of the war in the reversion to them of modern and completely equipped airports.

CHAPTER VI ADMINISTRATION AND PUBLIC HEALTH

ADMINISTRATION

THE administrative systems of Portugal and Spain have already been described in Vol. II, pp. 27-43, and Vol. III, pp. 53-78 respectively. As the islands are not regarded as colonies but as integral parts of their mother countries, in the same way as the Isle of Wight is considered to be a part of Great Britain, it is not necessary to repeat in full the methods of government which were detailed in the previous volumes. With some small exceptions the same system of administration and law apply in the islands as on the mainland.

The Canaries

Until 1928 this group of islands was regarded as one province of Spain under a Governor whose capital was at Santa Cruz in Tenerife. This system proved to be too rigid and was said to lead to negligence, and a royal decree of 21 September 1927, which was carried into effect in the following year, divided the archipelago into two provinces. The western group of islands, consisting of Tenerife, La Palma, Gomera, and Hierro, became the province of Santa Cruz de Tenerife with its capital at Santa Cruz in Tenerife. The local capitals of the other three main islands of this province are Santa Cruz for La Palma, San Sebastián for Gomera, and Valverde for Hierro. The eastern group, consisting of Gran Canaria, Lanzarote, Fuerteventura, Alegranza, Roque del Este, Roque del Oeste, Graciosa, Montaña Clara, and Lobos, became the province of Las Palmas with its capital at Las Palmas in Gran Canaria. The local capitals of the other two main islands of this province are Arrecife for Lanzarote and Puerto de Cabras for Fuerteventura.

The Falangist régime has confirmed the institution of the *man-comunidad* (inter-provincial association) which exists to-day in the Canaries and also the system of *cabildos insulares* (island corporations) for each of the seven main islands. The institution of cabildos insulares can be dated from the law of decentralization of 11 July 1912. When the Canaries were divided into two provinces in 1927 with governors in each of the two principal islands it was arranged that a deputy Civil Governor should reside on each of the other five main islands, and that a cabildo insular corresponding to a local *diputación* (Provincial Council) should be set up on each of the seven islands.

The island councils were to send representatives to one or other of the two inter-insular mancomunidades sitting in the capitals of the two provinces, while concerted action between the two mancomunidades was authorized where public works or services made it desirable. This machinery of island administration has continued under the Falangist régime, but nomination from above, as on the Spanish mainland, has tended to replace the election of provincial councillors.

From a legal point of view the archipelago forms two *audiencias provinciales* and one *audiencia territorial*. The headquarters of the latter court is at Las Palmas and its jurisdiction includes the Spanish possessions in Guinea and on the adjacent coast of Africa. There are 15 *partidos judiciales*, each with a judge. These are Las Palmas, divided into Triana and Vegueta; Guia, Telde, Orotava, Arrecife, Puerto de Cabras, San Cristóbal de la Laguna, Santa Cruz de La Palma, Los Llanos, Granadilla, San Sebastián, Icod, Valverde, and Santa Cruz de Tenerife. There are 92 urban and rural municipalities (*ayuntamientos*) in the archipelago and 2,053 recognized subdivisions of municipalities. All these divisions are of importance in a study of the census. The islands are served by two suffragan bishops with their headquarters at Las Palmas and La Laguna; both bishops are under the metropolitan of Seville.

Madeira

This island with Porto Santo constitutes one of the administrative districts of Portugal, having been raised to the level of the other districts of Portugal by a royal decree in 1835. The districts of the mainland were first constituted in 1833.

The chief authority is vested in the person of the Civil Governor, who is appointed by, and is a delegate of, the central government at Lisbon.

The district is divided into 11 urban and rural municipalities (*concelhos*) and each of these is subdivided into parishes. A public body is in charge of each unit. The Junta Geral is in control of the district administration and maintains the police force, the roads, and the schools. The *câmara municipal* of Funchal is of course the most important of the municipal councils; its chief function is to provide for paving and lighting of roads, the maintenance of public gardens, markets, and schools in the town.

The Azores

Until 1832 this archipelago was considered to be a colony and was under the rule of a Captain-General, but in that year it was declared

to be a province of Portugal with its capital at Angra in Terceira, the old colonial headquarters and still to-day the seat of the Bishop. This promotion in the administrative scale was partly due to the assistance which had been given by the islands in the restoration of Donna Maria II and the downfall of Dom Miguel. Dom Pedro, the young queen's father, made the declaration granting these rights to the Azores.

In 1836, three years after the old provinces of Portugal had been divided into districts, the new province of the Azores was subdivided into three districts, each known by the name of its capital. The eastern district of Ponta Delgada includes the islands of S. Miguel and S. Maria. The central district of Angra do Heroismo includes the islands of Terceira, S. Jorge, and Graciosa, while the western district of Horta is made up of the islands of Fayal, Pico, Flores, and Corvo.

Since 1941 the Azores have enjoyed a large measure of autonomy, which was conferred on them by a statute appended to the revised administrative code of 1940. The three districts, each administered by a Junta Geral, coincide with the sphere of jurisdiction of the three Civil Governors, here styled 'Governors of autonomous districts', whose functions are wider than on the mainland. In an emergency they are empowered to act on their own initiative in the name of the Government. All activities of the Junta Geral come under their immediate and permanent supervision.

The Junta Geral controls all local services such as agriculture, health, public works, and transport. The decisions of this body have to be submitted for government approval. Following the grant of autonomy the Government has made special financial provisions, handing back to the local executive certain revenues accruing from taxation.

The powers of the lesser administrative units, namely the municipalities (*concelhos*) and the parishes (*freguesias*), correspond in the main to those of their counterparts in Portugal. A special type of municipality with restricted powers has been devised for the small island of Corvo.

PUBLIC HEALTH

IN general the medical problems of the Atlantic islands are concerned mainly with intestinal diseases caused by contaminated food and drink, and can be met by careful supervision of supplies and by inoculation against the typhoid group. Details of the preventive

measures to be taken against common diseases and especially against those of an intestinal character, have already been given in Volume I (pp. 148-164) of this Handbook.

Insect-borne Diseases

Since there are no anophelene mosquitoes in the Azores and Madeira, malaria does not occur apart from isolated cases introduced from outside. A few deaths from malaria are reported from time to time in the Canaries, where the disease is probably present in the benign tertiary form. *Anopheles sergenti* and *A. hispaniola* are both found in Tenerife and Gran Canaria, the former being a proved, and the latter a suspected, carrier of malaria in countries bordering on the Mediterranean. Owing to the coolness of winter and aridity of summer in the Canaries, the breeding conditions are unfavourable to *Anopheles* and it is probable that malaria is not a serious problem. Nevertheless, it should be taken into account, as control measures may be necessary.

The vectors of yellow fever and of sleeping-sickness do not breed in the islands and the diseases cannot spread there, but it is possible for isolated cases to be introduced from parts of west Africa. This also applies to other diseases; thus plague was introduced into Madeira in 1905, and into S. Miguel (Azores) in 1921 when it caused 53 deaths. Modern methods of plague control throughout the world have greatly reduced the chances of a repetition of these outbreaks.

Intestinal Diseases

In the archipelago as a whole, and especially in Madeira and the Canaries, the death-rate for the typhoid group of fevers and for enteritis and diarrhoea, including dysentery, are proportionately far higher than is usual in Great Britain. In the Azores an outbreak of typhoid at Angra do Heroismo in 1919 was attributed, probably correctly, to contamination of the water-supply. Even in this group the disease is almost certainly endemic, and similar outbreaks could recur. Deaths from typhoid and paratyphoid fevers appear constantly in the government returns for the Canaries, hence intending residents should be effectively inoculated against these. In Madeira the condition sometimes known as Madeira fever is probably due to bacterial infection conveyed by food or water. Cholera was introduced there in 1910, but this is not likely to be repeated.

The incidence of diarrhoea, enteritis (mostly in children), and dysentery is relatively high. These diseases are usually conveyed in

water, milk, and other foods, and by contamination from flies, and many epidemics have been traced to carriers of the causative organisms who are themselves apparently healthy. As a preventive, all water should be sterilized, all milk boiled, vegetables and fruits of which the skins are usually eaten should be well cooked; salads grown by natives are to be avoided and precautions should be taken against flies.

Other Infective Diseases

Diphtheria and the other diseases of childhood are common. At least in Madeira and the Canaries, pulmonary and other forms of tuberculosis are more prevalent than in Great Britain; the majority of these cases are contracted through contact with existing cases. Meningitis (non-tuberculous) is constantly reported in the Canaries, but on the other hand small-pox has not occurred recently, practically the whole of the population having been vaccinated early in 1939.

Hospitals

In the Azores there are hospitals at Ponta Delgada, Vila Franca do Campo, and Ribeira Grande in S. Miguel, at Horta in Fayal, and at Angra do Heroismo in Terceira. In the Madeira group the main hospital is at Funchal. In the Canaries there are three hospitals, military or general, at Las Palmas and at S. Cruz de Tenerife, as well as several small clinics and nursing homes. Most of the hospitals have from 150 to 500 beds, the largest probably being that at Ponta Delgada which can accommodate about 900 patients; in many establishments the equipment leaves much to be desired.

CHAPTER VII

THE PEOPLES

ABORIGINAL INHABITANTS

THE Canaries were the only group of the Atlantic islands inhabited by a native population when they were discovered by Europeans. No traces of any extinct race have ever been found in either Madeira or the Azores, where the original thick tree-cover seems never to have been disturbed. The only evidences of visits to the latter islands before medieval times are the coins and strange hieroglyphics found in the Azores; these may have been left behind by Phoenician or Carthaginian voyagers as a record of their journey.

The Guanches

The name of 'Guanches' is commonly given to the native inhabitants of the Canaries, though it is strictly applicable to the people of Tenerife alone. The use of a general title, inasmuch as it implies a similarity in the native type and customs of the various islands, is only partly justified. One of the most interesting aspects of the Guanche people is in fact the differentiation from island to island; if it could be ascertained how long local conditions would take to cause such differences, there might perhaps be found a solution to the problem of their origin. Their isolation was made more extreme because they had no knowledge of boat-building, which might have put them in touch with their contemporaries, nor any knowledge of letters, which might have preserved for them the history of their past.

Thus, most of our information about the Guanches has come from their Norman and Spanish conquerors, who were concerned mainly with their fighting qualities and their use as slaves. The best authorities for the eastern islands are Bethencourt's chaplains Bontier and Le Verrier, whilst Espinosa, a Spanish friar who lived for many years in Tenerife, has left a second-hand but valuable account of the people there. These, with accounts of contemporary voyages and much later writings of Spanish colonists, are the main authorities about the Guanche people.

Origin

The question of the origin of the Guanches has for long been a matter of contention, and even when Espinosa wrote, in 1580-1590,

there were many opinions on the subject. Perhaps the most controversial of these opinions is that the natives were the last survivors of the race which occupied Atlantis, the great continent which, according to Plato, once stood where the Atlantic Ocean now is. The supporters of this theory say that the Guanches, owing to their character and simplicity, could have sprung from a few Atlantis shepherds who, whilst the floods surrounded and overcame the main continent, clung to the highest peaks and so survived. There is, however, no geological evidence to support this theory, the Canaries being of volcanic origin, with no very apparent connexion with other land-masses. It also seems strange that none of these shepherds should have remained either in Madeira or in the Azores to preserve a similar civilization.

A second suggestion is that the Guanches are the descendants of an African tribe who were exiled for revolting against Roman rule. After having their tongues cut out, that they might not boast of defying Rome, they were set adrift with several kinds of domestic animals and eventually reached the Canaries. Thus is explained the lack of oral tradition about their arrival in the islands.

Other theories attempt to explain one or other point about the Guanche customs, such as their knowledge of making mummies, which is attributed to Egyptian settlers. Fantasies adopting passages from the scriptures, which were multiplied by Spanish priests to further their religion, have no possible basis in fact.

It seems probable that the explanation is far more simple. Studies of the skulls of Guanches in the western islands show that they belonged to the dolicocephalic group of the Iberian race and were closely akin to the Basques and Celts. This indicated that the islands were very early inhabited by Berbers and Shilloucks who were wrecked there before these tribes had become much intermingled with Arabs and negroes. Espinosa in his work on Tenerife decided that they 'derive their descent from Africans, as well because of the contiguity of the mainland, as by reason of the close resemblance in customs and language and the method of counting'. The eastern islands were far more closely affected by later invasions, and Semitic and Arab skeletons have been found in Lanzarote and Fuerteventura. A legend firmly established in Tenerife recorded the arrival of sixty strangers in the island, but gave no hint of whence they came. These joined together and founded a settlement near Icod, now one of the larger villages on the north-west coast.

Characteristics

It is difficult to make even a rough estimate of the number of Guanches in the islands, because of their war-like nature, their habit of living in inaccessible caves, and their losses to slave-traders even before Bethencourt started his systematic conquests. Cadamosto, on reaching the Canaries in 1455 when three islands were still unconquered, said that Gran Canaria had 8,000 and Tenerife about 15,000 inhabitants. Another writer estimated that La Palma could muster about 500 fighting men and Gomera 700. It is probable that the islands as a whole had not more than one-fifteenth of the present population, if as much.

Descriptions of the Guanche physique vary in detail, but the early writers all agreed that 'these people had very good and perfect features, and well-shaped bodies', particularly in the western islands. They were especially impressed by their height and muscular ability, even the Normans, a fine people, finding them 'very tall'. From measurements of skeletons the average height of the men in Gran Canaria and Tenerife was about 5 ft. 9 in., many of them being considerably taller, whilst that of the women was 5 ft. 2 in. In Lanzarote the people were much shorter, the average height being 5 ft. 3 in., with the women little shorter than the men. With this difference in height was associated a difference in colouring. The taller people of Gomera, Hierro, La Palma, as well as of Gran Canaria and Tenerife, were more or less fair, some of them strikingly blonde with bright blue eyes. The shorter people of the eastern islands were very dark in colour with brown eyes. Espinosa also affirms that the inhabitants of the south of Tenerife were somewhat browner than those in the north of the island. Another characteristic of the Guanches was their particularly well-formed teeth, a Guanche prince being described as having 'a monstrous row of diamond-like teeth', which is borne out by the study of skeletons.

The race soon became famed for its strength and agility, the development of muscular strength being an important part of their education. They are described as 'lightly built, great runners and jumpers, for they are accustomed to the crags of this most mountainous island. They leap from rock to rock, bare-footed, like goats, and clear jumps of incredible width. They throw stones accurately and powerfully, so that they can hit whatever they wish. They have such strong arms that with a few blows they can shatter a shield in pieces.' To encourage this athletic prowess, which was very helpful to a race living in such country, they held regular contests, rather similar to the Olympic games, for which truces were held in time of war. A

heavy stone still preserved at Arico in Tenerife was normally used as a trial of strength and often raised to shoulder-height, though no one can move it now. Wrestling and strenuous dances were favourite amusements and helped further to develop their muscular abilities. It is not surprising that the conquerors found them 'difficult to take alive'.

The clothing of the people varied between the islands, but goat-skin or leather of some sort was generally used. Though a species of flax grew in the archipelago which might have been woven into a rough material, the Guanches had not discovered its use, probably because the climate made warm clothing unnecessary. In Tenerife, Espinosa records that the main garment was made of lambskins 'worn like a shirt without folds, collar, or sleeves and sewn with thongs of the same skin. This dress was called the Tamarco and was worn by all classes, the women wearing a skirt of leather underneath'. In the eastern islands the men wore a leather cloak and the women leather robes which reached to the ground. Woad is mentioned by Cadamosto as being in use in Gran Canaria, at least in times of war, and he remarked that they painted themselves 'green, red and yellow with pastes of herbs, and they consider such colours as a beautiful device, esteeming them as we do fine clothes'. Shoes and stockings in several of the islands were a mark of nobility; the only head-covering was made from goatskins.

Much has been written of the noble character of the Guanches, and in fact most of the tributes to their mercy and mildness are borne out by their behaviour to the Spaniards. Though they knew the trickery by which the conquerors often enslaved them, they continued to make Spanish prisoners work as butchers (a despised profession) and servants rather than kill them. Quite frequently, too, they returned them to their companions, and on at least one occasion guided them along precipitous paths to their ships. It is thought that the following description of them is not too inaccurate: 'they were virtuous, honest and brave and the finest qualities of humanity were found united in them: to wit, magnanimity, skill, courage, athletic prowess, strength of soul and body, pride of character, nobleness of demeanour, a smiling physiognomy, an intelligent and patriotic devotedness'.

Language

Unfortunately no study was made of the Guanche language whilst it was in use, for it might have given many clues to the origin and customs of the people. One of its most interesting aspects was the

variation between the islands, the early writers remarking that each island had its own peculiar language; it is, however, impossible to determine whether they differed fundamentally or were merely different dialects. Some authorities have noticed a slight resemblance to the languages of the American Indians, and others to that of the Moors of Barbary. In any case, their speech was apparently such an obscure mass of palatals and gutturals that the phonetic renderings of a few words and sentences can scarcely now serve as a sufficient guide.

Most is known of the language of the Guanches of Tenerife, owing to the early allegiance of the Güimar prince to the Spaniards whereby the people and their language were preserved there for some time after the conquest. Yet only nine sentences are on record, several of which are nearly identical, being concerned with the coronation oaths, and about ninety words, not including a great number of place-names many of which were retained by the Spaniards. These relics were fully studied by the Marquess of Bute in 1891, who tried to discover the grammatical texture of the language and established the use of the definite article.

The origin of the whistling language of Gomera has never been ascertained, but it was well established when Bethencourt's chaplains visited the island, and wrote that 'the natives speak the most remarkable of all the languages of these islands, talking with their lips as if they had no tongues'. Probably the extremely dissected nature of the island, separating villages which face each other across ravines by painful and dangerous tracks often 5 miles long, assisted the development of this language. The Spanish settlers learnt the art from the Guanches, and even to-day they can carry on a conversation by variation of tone and of length of note so that fairly long messages can be transmitted. The townspeople no longer use it, but in the country hamlets, and particularly near the central mountains of Chipude, it is still indispensable.

Mode of Life

Owing to the mild climate and the short duration of rainy spells, housing was scarcely a serious problem. Wherever possible, the people made use of the caves formed by lava streams, and Cadamosto says that they had 'neither walled houses nor huts of straw but live in caves and caverns in the mountains'. This, however, only applied to the western islands, and even there a few simple buildings have been found, one house still remaining at Tirajana in Gran Canaria. The site of Guanche colonies was almost invariably in the mountains,

and the entrances were almost inaccessible. Where a labyrinth of caves offered, only the front part was occupied and niches were hollowed out in the walls for sleeping quarters (Photo. 21). Some were decorated with complicated geometrical patterns in black, white, and yellow ochre. No caves were available in the eastern islands, and in Fuerteventura the conquerors found 'villages in great numbers and more closely together than is the custom with the inhabitants of Lanzarote'. Here the houses were made by excavating a large hole in the ground and then building a stone wall around it. A small staircase led to a low door, and the roof was formed of wood or large flagstones. A pile of stones was heaped above the roof, so that a village from a distance looked like low mounds of rock. A few of the buildings were undoubtedly more elaborate, but had the same primitive structure. It is interesting that in Tenerife the lord and elders and probably at least a proportion of the inhabitants moved down from the mountains to the sea-shore in the winter months, and returned again in the spring.

The Guanches knew only the rudiments of agriculture, their chief resources being flocks of sheep and goats. They also kept pigs, dogs, and rabbits for supplementary foods. Great care was taken of the animals, the people being 'very vigilant in preventing plants from growing which were not good for them'. The allocation of pastures was carefully determined, and disputes over pasturage were the most common cause of their frequent wars. With implements of obsidian, wood, and bone, the land was prepared in the spring for the sowing of barley, beans, and peas. The work of caring for the crops and storing the harvest was normally done by the women. As the land was neither irrigated nor manured, it soon became exhausted; then new land was broken up, the type of shifting agriculture resembling that of African natives. Wheat, dates, and figs were also grown, but not in all parts of the archipelago. Fishing was also only practised in a few of the islands, for whilst some of the natives could not swim, others were experts, and from Fuerteventura they regularly swam the 9-mile strait to Lobos. Two methods of catching fish were used in Gran Canaria; first, a poison from the euphorbia plant was placed in the water which stupefied the fish and brought them to the surface, where they were easily captured; and secondly, natives would swim out to sea and beat the water to frighten the fish, which were thus driven on-shore, where other men waited with spears and nets. Mounds of old shells, too, have been found, which suggest that the people ate large quantities of shell-fish, probably at feast-times.

The food of a people relying on such a limited agriculture was necessarily very simple. The staple diet was toasted and salted grain called gofio, ground in a mill and mixed with water, goats' milk, or grease. In times of scarcity this could be made from the seeds of the iceplant. Large quantities of mutton, goat-flesh, and pork were also eaten, either half roasted as in Tenerife, or preserved without salt, 'hanging it up in their houses till it is quite dry', as in Fuerteventura. A large lizard also added to the diet in Hierro, and was thought to be a particular delicacy. The natives made cheeses from goats' milk, which the early conquerors found 'superlatively good', and they also had much tallow, 'which they eat with as much relish as we do bread'. Their method of making butter was ingenious; two women would hang a goatskin filled with milk on the branch of a tree and then swing it from one to the other till the butter was made. They drank mainly water or goats' milk, though in Hierro a fermented drink was made from laurel berries. Espinosa wondered that 'men so valiant, with such strength and agility and with such fine faculties as they possessed, should have been brought up on such rough and coarse food'.

The Guanches were not natural craftsmen, and the implements and weapons they used were very primitive. Leather, however, was tanned with skill and the skins they wore were made extremely supple by rubbing them with stones. Pottery was little developed, red clay being moulded round large stones and left to dry in the sun. The mills used for grinding gofio were made of two hollowed pieces of basalt, turned by the insertion of a stick in the upper wheels. Their armour was scarcely elaborate, the chief weapons being slings, spears, and clubs. Very little use was made of shields, particularly in their local wars. In Tenerife, however, they were used, being made of dragon-tree wood, and light. The most remarkable gaps in their knowledge have already been mentioned, that of building boats, and of some form of writing. Even though the Atlantic swell is very heavy round all the islands, the natives could at least have used canoes to help them in their fishing close inshore. No inscriptions which can definitely be attributed to the Guanches have been found in the islands, and they must have relied entirely on oral tradition for their customs and legends.

Religion and Burial Customs

The form of religion varied between the islands, that of Tenerife being perhaps most easily changed to Christianity. Here they

believed in an invisible but all-powerful god who lived on the summit of the Pico de Teide, whilst the spirit of evil lurked below the peak in the midst of subterranean fires. Cadamosto wrote that in most of the islands they had no faith 'nor do they believe in God; some worship the sun; others the moon and planets; and they have strange idolatrous fancies'. Holy places were usually chosen near the summits of mountains, as in Tenerife and La Palma, where a strangely shaped rock was thought to be the seat of the god Idafe. As the Spanish priests soon discovered, 'they knew nothing of immortality, of death, nor of future punishment'. When they desired something very fervently they would assemble goats on one side of a ravine and their kids on the other hoping that the piteous bleating might touch the heart of the heavens. A ceremony curiously akin to baptism was practised; women, specially chosen, would pour water over the head of a new-born baby, though this apparently had no religious significance. Temples were not common, but were found in Fuerteventura, where sacrifices were made of goats' milk. The clergy were usually chosen from the nobles and seem to have lived in communities of their own. In some of the islands there were also communities of nuns, who prepared the leather robes for mummies and performed associated tasks.

The most interesting religious custom was the mummifying of kings and nobles in Gran Canaria and Tenerife. The process of preparing them was elaborate and was the most developed of their arts. Espinosa gives us the following description of the methods employed in Tenerife:

'Taking the body of the dead after it was washed, they forced down the mouth certain confections made of melted mutton grease, powder of heath, and of stones, bark of pine trees and I know not what else, cramming the preparation down each day, and putting the corpse in the sun on one side and then on the other for the space of fifteen days, until it was dry. During this time the relations mourned and wept, for there were no obsequies after the end of it. The corpse was then sewn up and enveloped in leather from certain heads of the flock, selected and set apart for that purpose.'

When ready, the mummies were placed in caves difficult of access which in Gran Canaria were often hollowed out near the sea. Pieces of Guanche mummy were highly valued as drugs in the middle ages, and combined with the resin of the dragon-trees were supposed to be essential for the making of the philosopher's stone.

Methods of Government

The power of government was usually held by the strongest of the nobles, though hereditary succession was the custom in some of the islands, authority passing from brother to brother rather than from father to son. The larger islands were often divided between various lords. In Tenerife, after the death of a king who had ruled the entire island, this was divided among his nine sons, who were called *Menceys*. The chief of these was the Mencey of Taoro who governed the region around Orotava, but he seemed to have little actual authority over the other kingdoms. In Gran Canaria one queen had succeeded in uniting the various kingdoms that had constantly waged war on each other before, and so the people were able to offer a united and prolonged struggle against invasion. In Fuerteventura authority seems to have been somewhat confused, the south-western peninsula being cut off by a wall from the rest of the island; there were almost continuous wars between the inhabitants on either side.

The election of the Mencey in Tenerife was an occasion for some ceremony. The elders were assembled at a chosen place, with, as the symbol of authority, 'a bone of the most ancient lord in their lineage, wrapped in skins and guarded'. This bone was then placed on the shoulder of the new lord, who gave and received several oaths of allegiance in a set form of words. Banquets and games followed, and it was not unusual for one or two people to throw themselves over a precipice to honour the new lord, and to gain his compassion for their families.

The priests, all of the noble class, had invented some ingenious social theories. The nobles, who were a people apart with special privileges and distinctions, were said to be the first race created, and were provided with flocks to sustain them. Later, when the earth was found to be capable of holding a larger population, more people were created but were not given equal flocks, and were told instead 'to serve these others, and they will give you to eat'. Strongly marked social classes had become engrained in the life of the Guanches.

Laws were usually made by the elder nobles at special places, called *taoros* in Tenerife. As a whole, they seem to have been strict, though our information about them is somewhat confused. Their more extreme punishments were burying alive or forcing the criminal over a precipice or cliff, but in some islands the death penalty was not used. Death was normally considered an honourable atonement,

though in cases of treachery the culprits were often forced instead to do butcher's work and to live in special communities, which were not allowed to have any relations with the rest of the population.

Survival of Guanche Customs

As the remnants of the Guanche people were absorbed and not exterminated, some fragments of their way of living were retained by the Spanish settlers. It has often been suggested that the mildness of character and low rates of crime in the Canaries are due to the Guanche ancestry, but such connexions are hard to prove.

Several links amongst minor customs can, however, be traced between the Guanches and Spaniards. Many of the Guanche place-names, some surnames, and a few words are still in use in the islands. Gofio is still the staple diet of the labouring classes, and poison from the euphorbia continues to be used by fishermen. Pottery at La Atalaya is still moulded round large stones; and in many of the Canaries the poor and destitute still find a cave hollowed in a lava flow a convenient and sufficient home.

MODERN INHABITANTS

The Canaries

The present inhabitants of the Canaries are almost entirely of Spanish origin. They speak the Spanish language, though in a somewhat corrupt form, and are entirely imbued with Spanish customs and ways of life. Yet there is, in the islands, an intense dislike for the distant rule of the Peninsula, and the small number of Spanish officials are felt to be more concerned with the gathering of taxes for Madrid than with the improvement of the islands themselves. So intense is this dislike that to call Canarios by the name *Espanoles* is a deep insult. Local loyalty, too, is deeply felt within the archipelago, and there has been at times great jealousy between the larger islands, particularly Gran Canaria and Tenerife.

In appearance, some of the people differ markedly from the typical Spaniard. The most common type is the very dark-skinned Canario, with black eyes set in a thin face; in the south of Tenerife, Gran Canaria, and Hierro there are, however, a few blonde tall people with very blue eyes, reminiscent of the descriptions of the Guanche. There is also an interesting variation with altitude, the darker types living on the coasts and the tall fair people in the mountains. In character, the Canarios as a whole are supposed also to resemble the Guanches.

closely, and to them, as noted above, has been attributed their mildness and kindness of temper. They are much interested in strangers and have a great curiosity about them, especially in the smaller islands. Politics are heatedly discussed in some circles, but as the islands count as only two provinces of Spain they can have little decisive influence on the main political trends of the mainland. The ordinary Canario is in fact more interested in the festival days of the Church, which are still maintained with much ceremony; in an occasional bull-fight or wrestling match; and in the progress of the banana and tomato crops.

In costume, the Canarios generally wear normal European dress, though the women often still cling to the Spanish mantilla. The traditional costumes are now only retained in the most remote villages. In Tenerife, women's head-dress is elaborate; first one silk handkerchief is placed on the head, a second twisted into a turban is set above it, and both are surmounted by a small hat of straw or felt. In Gran Canaria and the eastern islands the men favour a very wide-brimmed felt hat, rather like a sombrero. Hierro, being small and isolated, tends to preserve its local costumes longest. A peculiar hat called the *montera* is worn there, in shape somewhat like a large bonnet; it is made of brown material and is decorated with a tassel at the side. This has a somewhat ridiculous air when worn straight, but is normally pulled down on one side and used as a container for pipe and tobacco. Their shoes, too, are locally made, consisting of a tough leather sole larger than the foot, attached to the ankle by leather thongs; these are ideally suited to the uneven lava surfaces.

The food and housing of the peasants are simple. Gofio is the staple food, and is eaten in lumps resembling dough. With it they eat mainly salt fish, sweet potatoes, and yams; meat, usually pork, is kept for feast-days and holidays. The local wines are not of very high quality, and goats' milk is commonly drunk. The houses are the simplest of buildings, usually whitewashed as in Spain, but with no attempt at decoration or style. Only the wealthy in the larger towns build houses of some architectural merit, and these are often surrounded by most carefully planned gardens.

Culture is not well developed in the Canaries, mainly owing to the very low level of education. This is not entirely the fault of the State or of the people; in an island such as Gomera adequate arrangements for education are almost impossible, as the small hamlets are scattered and are separated by long, rough, and dangerous tracks. Thus is explained the great power of the parish priest, often the only man in

the remote hamlets who can read and write. The people are fervent members of the Roman Catholic Church, which enters very prominently into their lives. Church festivals cause a complete stoppage of work in country districts, and with the whole village attending the processions, transport and service are then almost impossible to obtain.

Local labour is usually unskilled, the people being almost all agriculturists. Though the old method of paying according to the price of maize has now died out, the labourer gets little more actual value for his goods despite nominally much higher wages. The rate of pay varies between the islands; in June 1941, 8 to 10 pesetas a day were paid to unskilled labourers in Tenerife.

Madeira and the Azores

The people of the Madeiras and Azores are mainly of Portuguese descent, and Portuguese customs and way of life are firmly embedded in these 'adjacent islands' of Portugal. In Madeira there is, however, an admixture of Jewish, Moorish, Italian, and negroid ancestry in the lower classes. After the abolition of slavery in 1775 there was much intermarriage between the white and negro inhabitants, to which is due the prevailing darkness of eye and complexion. In the Azores the Flemish ancestry of some of the early colonists is still preserved in some of the surnames, which often seem strange for a Portuguese society, and in the startling contrast of children with flaxen hair and bright blue eyes compared with the darker Portuguese types. Portuguese is the only language used in the islands, but in Madeira and Horta English is often understood.

The people of both archipelagos are mainly a fishing and farming peasantry, honest, industrious, peaceful, and inoffensive to a degree. Very few crimes are committed in the islands, and little interest is taken in revolutionary politics. There is practically no middle class, and the wealthy are very few in number. The heaviness of taxation, regarded locally as levied chiefly for the benefit of the mainland of Portugal, is severely felt; for the betterment of the islands, further local taxes have to be raised.

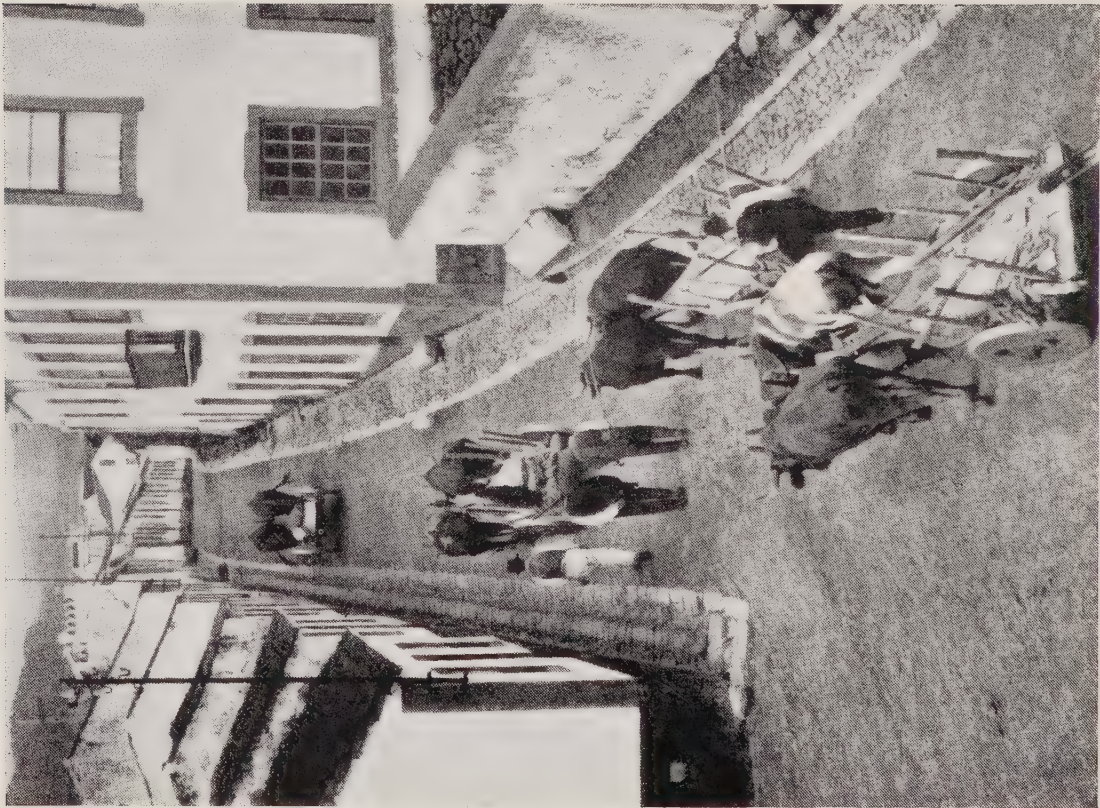
The traditional costumes of the islands are no longer worn, though much of the cloth used is home-produced. In Madeira the home-spun skirts worn by the women vary from parish to parish with the differing taste in dyes. Handkerchiefs are the usual headgear, the most devout wearing white ones. The clothes worn by the men are entirely European, but a group of fishermen on Funchal beach will



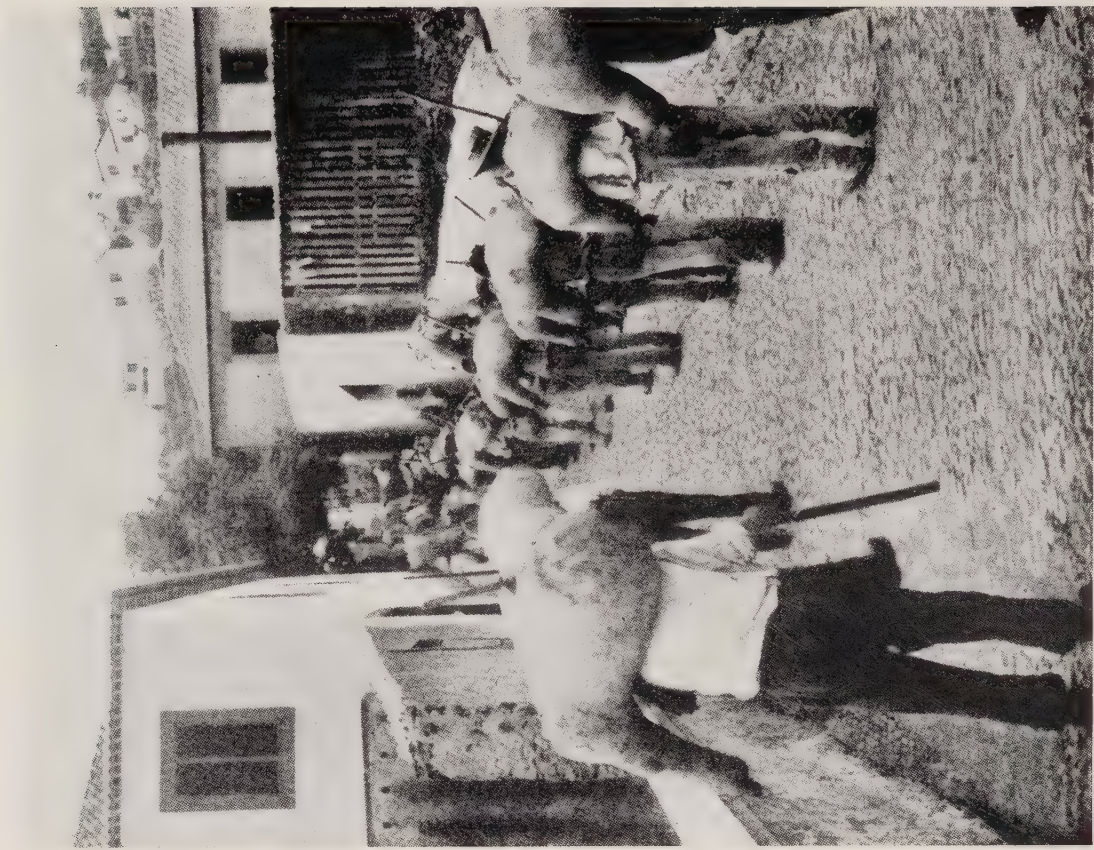
21. *Guanche cave-dwellings in Gran Canaria*



22. *Women wearing the capote at Horta, Fayal*



23. Carts in the outskirts of Angra do Heroísmo



24. Carrying wine in goat-skins, Madeira

often give one an increased respect for the picturesque art of patchwork. The famous *capote*, a cloak and hood worn by the women of the Azores and thought to be of Flemish or Algarve origin, is now rarely seen. That of Fayal was comprehensively described (Photo. 22) by Mark Twain as made

'of thick, blue cloth attached to a cloak of the same stuff, and is a marvel of ugliness. It fits like a circus tent and a woman's head is hidden away in it. There is no particle of trimming about this monstrous capote, as they call it. It is just a plain, ugly, dead blue mass of sail, and a woman has to go before the wind or not at all. The general style of the capote is the same in all the islands, but each island shapes its capote just enough differently from the others to enable an observer to tell at a glance what particular island the lady hails from.'

The men rivalled this headgear with the *carapuça*, made in a rather similar material with a large peak in front and a flap of material behind as a protection against wind and sun (Fig. 13). To-day the material used is still home-woven from local flax and wool. Many of the people go barefoot, or wear rough sabots which are made locally. In both the archipelagos black is worn for ceremonial occasions, and deep mourning is always worn for long periods even for distant relations.

The food of the islanders is simple, but is varied greatly by the abundance of fruit and vegetables. In Madeira bread, which is relatively expensive, coffee, and vegetable soups are the staple foods, with salt fish on Fridays and meat, often pork produced by the much prized family pig, on feast-days. The people do not drink the Madeira wine of commerce but a much more fiery brand which is fortified by raw alcohol. In the Azores, too, fresh meat is a rare delicacy, maize-bread being the staple of a diet often varied by salt fish, salt pork, goats' milk cheese, white and sweet potatoes, and yams. The houses of the people in rural areas are usually very simple whitewashed structures, with very little furnishings (Photo. 23). The importation of goods to improve the standard of living is made almost impossible by the extremely heavy taxes on all imports which often double the price. The houses are frequently owned by their occupants, and there are no cave-dwellings.

The favourite amusements are simple. In the Azores bull-baiting is very popular, the bulls often being loosed in the streets; whilst the young men show their bravery by provoking them, the rest of the populace divert the bull's attention and so help the amateur matadors to escape. Cock-fighting is a favourite diversion in the spring. Football has enjoyed great popularity in Madeira. The festivals of the

Church are, as in the Canaries, the major holidays of the people, and processions are elaborate and impressive. On New Year's Eve, Funchal Bay is illuminated with rockets and bonfires.



FIG. 13. *Traditional Azorean form of Headgear (carapuça)*

The state of education suffers the same difficulties as in the Canaries, and most of the peasants are illiterate. Considerable improvements are being made, however, under the Salazar Government. Some of the wealthy families in the Azores send their children to Portugal or to the United States for higher education.

The labour available in the islands is industrious and thrifty, though mainly unskilled. In the Azores the rate of pay for unskilled labourers is between 8 and 12 escudos for an 8-hour day, though mechanics are paid from 16 to 20 escudos.

CHAPTER VIII

COMMERCE

THE commerce of the Spanish and Portuguese Atlantic islands is relatively small and varies to a more than ordinary degree with the whims of outside markets. Most of the main commercial crops have been either introduced or greatly encouraged by means of foreign capital and the carrying trade is done mainly in foreign ships; few of the exports are sufficiently indispensable to guarantee a ready sale in available markets during time of war. In all three archipelagos the outbound trade consists largely of fruits and vegetables, while the imports are mainly fuels, manufactures, and cereals. It is of great significance that lands so rich in fruits should not be self-sufficient in essential foodstuffs.

For quantity and value of trade the Canary group is by far the most important of the three, since it has a considerable surplus of agricultural products and its position attracts a great many vessels that call for fuel and provisions. Funchal in Madeira is also a port of call and has an important tourist traffic, but the smallness of the archipelago greatly restricts its commercial possibilities. The Azores are larger than Madeira and have a more varied economic production, but they are visited by few regular steamer services. However, the commercial disadvantages of their relative isolation may be overcome by the trade accruing from a position on important airways.

The following description deals mainly with the external commerce of the island-groups. Further particulars concerning inter-insular traffic and full details of the trade of the main ports are given in the detailed descriptions of individual islands.

THE CANARIES

During 1933, which may be assumed to be a 'normal' year, the total external commerce of the Canaries amounted to 1,549,000 metric tons valued at 210 million gold pesetas. The table on p. 98 shows the nature of this trade. It will be seen that in a normal year the imports are over three times the tonnage and nearly double the value of the exports.

Imports

The purchases from abroad (Appendix C) normally consist of manufactures, coal and fuel oil for bunkering, foodstuffs, and the various agricultural requirements of the fruit-growers.

The manufactured goods needed by the population are almost entirely brought in from outside, the chief imports being hardware and machinery of various types, cotton goods and other textiles, rubber goods, paper, matches, and pottery. The iron and steel products are shared mainly by Belgium, Germany, and Great Britain, but the latter has a considerable lead in the textile trade, except in hemp and flax.

	<i>Imports</i>		<i>Exports</i>	
	<i>Tons</i>	<i>1,000 gold pesetas</i>	<i>Tons</i>	<i>1,000 gold pesetas</i>
Livestock . .	245	191	1	..
Raw materials .	440,637	22,990	858	378
Manufactures .	568,555	73,098	75,307	10,270
Foodstuffs . .	199,301	34,130	263,988	68,652
ANNUAL TOTALS .	1,208,738	130,409	340,154	79,300

The purchases of coal for bunkering reached their peak about 1912, when no less than 1,347,000 tons were imported. In recent years the amounts have fluctuated between 150,000 and 300,000 tons. At the same time the imports of petrol and fuel oils have increased and in 1933 totalled 594,600 tons. During this year the main kinds of oil imported were fuel oil (291,000 tons), crude oil (149,000 tons), Diesel oil (127,000 tons), illuminating oils (13,000 tons), and petrol (11,000 tons); most of the remainder consisted of lubricating oil. Great Britain supplied the bulk of the coal, while the oil came mainly from the U.S.A., the Dutch West Indies, and Venezuela.

The Canaries normally need to buy from abroad between 10,000 and 13,000 tons of food a month, by far the chief requirements being maize, wheat, and flour (total import nearly 90,000 tons in 1933), which are obtained mainly from Argentina. There is also a considerable import of sugar, dried vegetables, and potatoes (partly for seed), as well as of smaller quantities of fish, poultry, coffee beans, olive-oil, tinned goods, and various other foodstuffs. Great Britain is usually the chief supplier of potatoes, sugar, and preserves.

The requirements of the local fruit-growing industries give rise to purchases of timber and fruit-packing materials such as wood for cases, crates, and staves, of considerable quantities of artificial manures, sulphur, and certain chemicals. The timber and wood products come mainly from Sweden and Portugal; the artificial manures and chemicals from Great Britain and Belgium; the sulphur from France and Italy.

The above details show that Great Britain occupies an important, and often a leading, position in the list of countries sending goods to the Canaries. On the other hand, the imports coming from the Spanish mainland are relatively small and in 1933 only totalled 35,000 tons, worth 11 million gold pesetas. The chief goods involved are wines, spirits, olive-oil, dried vegetables, and sandals, in all of which Spain has a virtual monopoly.

Since 1940 one result of the decrease in the import trade of the countries of north-western Europe has been that the Spanish mainland has become the leading supplier of the Canary market. In 1942, when the total imports of the archipelago were valued at 90.4 million gold pesetas, nearly two-thirds of the traffic came from the home country.

Exports

The main items sent abroad are bananas, which normally form 50 per cent. of the total tonnage and value of the export trade, and tomatoes, which comprise a further 20 per cent. The banana traffic varies annually with the harvest and has fallen to nearly 100,000 tons and has risen to 220,000 tons in recent years. Usually France takes two-thirds of the shipments and most of the remainder goes to Spain and Great Britain. During the period 1930-1941 the export of tomatoes decreased from 123,000 tons to about 25,000 tons, the latter figure being abnormally low owing mainly to the closure of the British market, which generally took three-quarters of the supply.

Other exports include new potatoes (which are sent mainly to Great Britain), cured, salted, and tinned fish (to Spain, Spanish African possessions, and Italy), cigars and cigarettes (mainly to Spain), petroleum products (to Spain and Spanish Morocco), embroidery, and drawn linen-work. In addition, small quantities of cochineal are shipped to France. Of the total exports (340,000 tons in 1933) in a normal year just over one-third goes to Spain, whereas since 1940 the home country has taken the bulk of the shipments, as is shown in Appendix C. In 1943 about 40,000 tons of bananas, 16,000 tons of tomatoes, 1,069 tons of onions, and 5.7 tons of cochineal were exported, all presumably to Spain and Spanish African possessions.

Shipping Lines

For commercial purposes the Canary Islands occupy an advantageous position on the main trade routes from Europe to South America

and to west and south Africa. Not only is the freight carried on these routes very great, but the calling of vessels of various nationalities greatly facilitates the import and export trade of the Canaries, besides giving rise to a considerable fuelling business and a valuable tourist industry. The normal shipping facilities may be judged from the following list of the main steamship lines which were calling regularly at the islands during the early part of 1939:

British lines:	Shaw Savill (Liverpool to S. Africa and Australia) Elder-Dempster (Liverpool, and London to gulf of Guinea) Blue Star (London to S. America) Natal (London to S. and E. Africa) Royal Mail (London to S. America) Union-Castle (London to S. and E. Africa) Yeoward (Liverpool to Canaries)
German lines:	German Africa (Hamburg to gulf of Guinea, and to S. and E. Africa)
Italian lines:	Italian (Naples to Vancouver; Genoa to east and west coasts of S. America) Lloyd Triestino (Trieste to S. Africa)
French lines:	Navigation Paquet (Marseilles to Canaries) Faire et Fraissenet (Marseilles to gulf of Guinea)
Spanish line:	Trasmediterránea (Barcelona, and Bilbao to Canaries)
Belgian line:	Maritime Belge (Antwerp to gulf of Guinea)
Norwegian line:	Fred Olsen

In March 1941 only the Spanish line and two or three of the British lines were still being maintained; in more recent years the only regular services have been those with Spain.

MADEIRA

Few statistics are available of the quantities of goods imported and exported from the Madeira group, as its trade is included in that of Portugal, no separate official lists being published. It happens, however, that the international commerce of the archipelago is carried on almost entirely through Funchal, for which port certain trade statistics are available.

Imports

The chief foreign purchases of the Madeira group are coal, grain, general merchandise (especially manufactured goods of various kinds),

oil, and petrol. In 1937, when nearly 124,000 tons of goods were received at the port of Funchal, about two-thirds of this tonnage consisted of coal and another one-sixth of grain. Normally the bulk of the coal comes from Britain and most of the grain from Africa (maize and rice) and North America (wheat). The local needs of grain have to be supplemented by the import of about 1,000 tons of wheat and 750 to 1,000 tons of maize a month. In 1939 the imports of foreign flour were limited to 1,600 tons a year, while the dues on maize from the Portuguese African colonies were temporarily suppressed. Other goods brought in from abroad include meat (from the Azores), olive-oil for use in the tinning of tunny, tobacco, and small quantities of clay for brick-making. The imports of mineral oil are intended for refuelling ships and to meet local needs, such as Diesel oil for the power station at Funchal. The main supplier of goods to Madeira is Britain, which in the period 1935-1937 sent merchandise worth on an average about £290,000 a year.

Exports

The shipments from Madeira consist mainly of wine, fruits and vegetables, embroidery, willows and wickerwork. The chief product is wine, exports of which reached a high level of 4.8 million litres in 1925 but averaged 3.5 million litres in 1933-1935 and 4.2 million litres in 1935-1937. It is probable, however, that these statistics, although from official sources, are somewhat exaggerated. British merchants have largely controlled the wine trade since the end of the seventeenth century and at times have comprised two-thirds of the wine merchants on the island. Blandy Co., Cossart, Gordon Co. (founded in 1745), and many others are British. In 1940 there were 33 firms engaged in the export of wine, whereas ten years earlier there were said to be about 100 firms. France and Germany are usually the chief purchasers of Madeira wine, which has lost some of its former popularity in the British market.

The fruit-exporting trade was carried on by 38 firms in 1940, the chief products being bananas, avocado pears, and custard apples. In 1939, when 7,491 tons of bananas and 75 tons of other fruits were exported, nearly all the bananas went to Portugal. From January to October 1940 the shipments to the homeland included 3,802 tons of bananas. The sale of vegetables is also important; in 1939 about 6,000 tons were exported, the bulk consisting of potatoes and onions, and much of the remainder of beans.

The exports of embroidery and of drawn linen-work reached their

peak in the early twenties of this century and still remain of high relative value, although the trade has been adversely affected by the export of inferior work by foreign dealers. In the period 1936-1937 the average value of linen-work exported was £150,000, whereas the corresponding value of wine shipments was about £110,000. In addition to these exports there are in normal years the quantities of embroidered articles sold direct to visitors. The sale of wickerwork furniture and of willows has much declined since 1913, when 183 tons were exported, 30,000 wickerwork chairs being shipped to South Africa alone. In the first nine months of 1940 Madeira sent 15 tons of wickerwork to Portugal.

The minor exports from Funchal are cane sugar, canned tunny, cheese, and canned butter, all of which go mainly to Lisbon. The export to Portugal of surplus sugar up to 850 tons has been authorized since 1939, the first 200 tons being duty free. It is possible also that since 1941 there has been a small export of whale oil.

The shipments from Funchal in 1937, including merchandise for re-export and in transit, totalled 142,000 tons. During the years 1935-1937 Britain took goods worth £174,000.

Shipping Lines

Previous to 1939, Funchal was visited by about 1,200 vessels a year, most of which were merchant vessels and tourist ships engaged on routes from Europe to South Africa and South America. The chief British lines calling regularly on weekly, fortnightly, and thrice-monthly schedules were as follows:

Union-Castle:	(London and Southampton to S. and E. Africa)
Royal Mail:	(London and Southampton to S. America)
Elder-Dempster:	(Liverpool and Hamburg to gulf of Guinea)
Booth:	(Liverpool and Penarth to Madeira and S. America)
Yeoward:	(Liverpool to Canaries).

The leading German lines were the Woerman, Nord-deutscher Lloyd, Hamburg, Sud-Amerika, and Hamburg-Africa. The two French companies that supplied a regular service were the Chargeurs Reunis and the Transports Maritimes à Vapeur, the latter sailing from Marseilles and Genoa. In addition, there were a Dutch line from Amsterdam and the two lines from Lisbon which were still being maintained in 1944 by the Cia. Nacional and the Emprêza Insulana de Navegação.

THE AZORES

Like Madeira, the Azores are treated statistically as part of Portugal and no separate quantitative analysis of imports and exports is given in the official statistics. The islands of the archipelago are widely scattered and few are large enough to be of any commercial importance. The international trade is done almost entirely through Ponta Delgada in S. Miguel, Horta in Fayal, and Angra do Heroismo in Terceira, the first being by far the most important. A fairly reliable estimate of the relative size of the trade of these ports may be obtained from the following table of shipping departures in 1934.

	<i>Number of ships leaving</i>	<i>Aggregate tonnage</i>
Ponta Delgada	262	975,065
Horta	260	435,129
Angra do Heroismo	154	217,913
TOTAL	676	1,628,107

Details of the trade of each port and of the inter-insular traffic of the archipelago are given in the detailed descriptions of the individual islands.

Imports

Under normal conditions the Azores are almost self-supporting in foodstuffs, enough wheat being grown to supply three-quarters of the local needs. Consequently, the imports consist mainly of coal, petroleum, textiles, and other manufactured goods. Coal comes mainly from Britain; petrol and oils from the U.S.A.; textiles from Portugal; stationery, hardware, chemicals, paints, and various machinery and machines from the United Kingdom, Germany, and France. In addition relatively small quantities of flour (from Lisbon), wine, sugar (from Germany and Madeira), salt, and other foodstuffs are imported. The aggregate trade is not large, as may be judged from the fact that the total imports in 1939 were valued at £153,000 and that in the period 1935-1937 the annual purchases from Britain, one of the main suppliers, were on an average worth about £36,000.

Exports

The Azores are more valuable for their geographical position than for their production. Sugar, first cane and later beet, and oranges used to be important exports, but they have now lost their markets. To-day the chief commercial products are pine-apples; cattle, dairy

products, fish, and vegetables. By far the leading export is the pineapple, which is grown in forcing houses mainly on S. Miguel. The number exported in 1939 was 1,277,000 or about half a million less than in 1938. During 1940 the trade slumped seriously and attempts were begun to preserve and pulp the large unmarketable surplus. In normal years Germany buys the bulk of the crop.

The most promising development of the export trade in recent years has been the growing shipments of cattle and dairy produce to Lisbon and Spain. During the first nine months of 1940, of the 9,600 tons of merchandise sent to Portugal over 2,000 tons consisted of cattle, while in 1941 about 7,600 beasts from the Azores were slaughtered in Lisbon. Canned butter and cheese now form regular shipments.

The main fishery products exported are preserved sardines, pilchards, and tunny, but the whaling industry still survives and in 1940 yielded 1,680 tons of oil, much of which went to the homeland. The minor exports include chicory, tea, oranges, tobacco, and alcohol. The total exports of the Azores in 1939 (a low year) were valued at £122,000 or half the value of those in 1913. Normally pine-apples provide about half the total value of the export trade. From 1935 to 1937 Britain was taking goods worth on an average £73,000 a year, and shared with Germany and Portugal the position of leading purchaser of Azorean products.

Shipping Lines

The Azores are not upon the great trade routes of the North Atlantic, although a considerable number of vessels visit the islands for coal, provisions, and minor repairs. In normal years the main lines serving the archipelago are the *Emprêza Insulana de Navegação* of Lisbon, the *Carregadores Açoreanos* of Ponta Delgada (from north-west European ports), and two lines from the Mediterranean ports to New York.

In 1941 the only commercial vessels calling with any regularity were those of the *Emprêza Insulana de Navegação*, which maintained a fortnightly service between Lisbon, Madeira, and the Azores by means of two vessels of 4,560 and 3,865 tons gross respectively. These ships carry freight, passengers, and mail to all the islands on each trip, except to S. Maria, which is only visited once a month. However, landings at Flores and Corvo in winter are frequently rendered impossible by heavy seas. This company also maintains a regular monthly freight service from Lisbon by a ship of 773 tons gross. Occasionally one of its larger vessels may make a trip to New York.

In addition to the above line, Carregadores Açoreanos have operated since May 1940 an irregular passenger and freight service between Portugal, the Canaries, Madeira, the Azores, and the United States. It was in June 1940 that this company, which was formed by the local pine-apple planters, initiated the first direct cargo service between Lisbon, the Azores, and New York. Its main vessels are 5 steamships totalling about 10,000 tons gross.

A further freight service is maintained once a month by Mutualista Açoreana of Ponta Delgada by one ship of about 325 tons gross, while the ships of the Cia. Nacional of Lisbon may call at the Azores on their way to New York.

CHAPTER IX

SIGNAL COMMUNICATIONS

FROM an international point of view, the chief importance of the signal communications of the Canaries, Madeira, and Azores lies in their function as centres for submarine cables. The local development of telephone, telegraph, and wireless transmission is relatively poor by British standards, but, except in the most barren islands, compares favourably with conditions in the rural areas of Spain and Portugal.

THE CANARIES

Telephone and Telegraph

There is no telephone system in Fuerteventura and Hierro. In Gran Canaria, Tenerife, La Palma, and Gomera telephonic communication is maintained between all the towns and most of the larger villages in each island. The system is operated by the Cía. Telefónica Nacional de España, whose headquarters are in Madrid. The wires are laid above ground, and in 1941 the subscribers in the Canaries numbered about 4,500. Inter-island connexions are by means of a submarine cable from Regla Bay (Tenerife) to Sardina Bay (Gran Canaria). Foreign telephonic connexions depend on the international relay station at El Tabero, about $7\frac{1}{2}$ miles south-west of S. Cruz de Tenerife, which transmits to Pozuelo del Rey and receives from Griñon, both near Madrid (Fig. 14).

The use of the telegraph is less extensive in the Canaries than that of the telephone except in Fuerteventura, where the local signal communications are limited to a telegraph system centred on Puerto de Cabras. Both Gran Canaria and Tenerife have land telegraph connexions between most of the chief towns, the network being least thin in the area near S. Cruz and La Laguna in Tenerife. The system is owned and operated by the State, all necessary supplies being obtained from Spain. There were no printing-telegraphs in use in 1940.

Submarine Cables

There are two Spanish-owned cables connecting the Canaries with Cádiz, the one running direct from Las Palmas and the other direct from S. Cruz de Tenerife. In addition there are an Italian cable from Confital Bay (Las Palmas) to Málaga in Spain and a French

cable from Tejita, Tenerife to Saint Louis, Senegal. In September 1942 the Spanish cables were interrupted and the Italian cable had been cut.

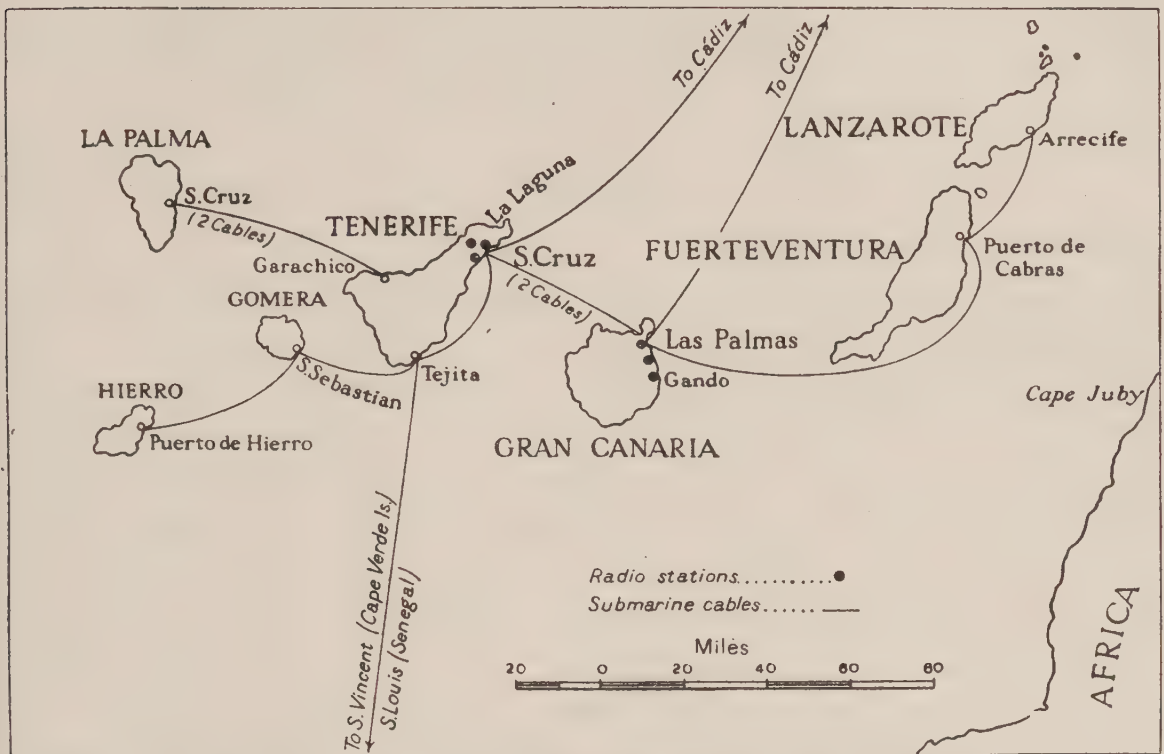


FIG. 14. *The Signal Communications of the Canaries*

Each island of the group is served by at least one local cable, the terminals of which are shown in the following list and in Fig. 14.

Regla Bay, Tenerife	– Confital Bay (Las Palmas) Gran Canaria; 2 cables.
Garachico, Tenerife	– Bajamar (near S. Cruz), La Palma; 2 cables.
Tejita, Tenerife	– S. Sebastián, Gomera; 1 cable.
Las Palmas, Gran Canaria	– Puerto de Cabras, Fuerteventura.
S. Sebastián, Gomera	– Puerto del Hierro, Hierro.
Puerto de Cabras, Fuerteventura	– Arrecife, Lanzarote.

In addition to these cables, all Spanish-owned, there is an Italian cable (now cut) from Tejita in Tenerife to São Vicente in the Cape Verde islands.

Wireless Telegraphy, Telephony, and Broadcasting

The position and relevant technical details of the wireless (W/T) and radio (R/T) stations in the Canaries are given in Appendix D. It

will be noticed that stations occur only near Las Palmas and the air-field of Gando in Gran Canaria and near S. Cruz and La Laguna in Tenerife.

From various reports it appears that in recent years there have been, at least for short periods, a broadcasting station at Las Palmas and another at Tenerife. Neither had a power exceeding 0.25 kW.

MADEIRA

Telephone and Telegraph

Funchal has a telephone (C.B.) exchange on top of the Câmara Municipal with nearly 1,000 lines. The system is antiquated and unreliable as well as being short of accommodation for new subscribers. However, the town is already wired for an automatic service and a temporary exchange for use during the transition period had already been installed early in 1942. From Funchal a trunk-line system makes a complete circuit of the island and crosses it at three points, thus connecting all the main villages. The rural system consists of overhead wires, the only underground cables being in Funchal itself. The service outside the capital is said to work fairly well during daylight, but it is shut down at night. Only the most remote villages of Madeira, about 20 in all, lack telephonic communications. Porto Santo and the other islands of this group have neither land telephones nor telegraphs.

The telegraph system is antiquated also, but gives a good service. It serves, by means of single, overhead wires, the towns and most of the larger villages of Madeira. Since the introduction of the telephone trunk system most telegrams are transmitted by this means.

Submarine Cables

Funchal is of some importance as a transmission point for trans-Atlantic cables. Six cables land here on the coast just east of Forte de Santiago. Of these two run to Carcavelos near Lisbon, three to São Vicente in the Cape Verde islands, and one to Porthcurnow, Cornwall. All are operated by Cable and Wireless Ltd. (Fig. 15).

Wireless Telegraphy, Telephony, and Broadcasting

The only radio stations in the Madeira group are at Funchal and at Ponta do Garajão (3 miles east of the capital) in Madeira, and at Vila Baleira in Porto Santo. The technical details available about these stations are given in Appendix D.

Broadcasting is very little developed in this archipelago. In 1939, just before the Portuguese Government banned broadcasting, a small commercial radio station was transmitting from Funchal. Broadcasts from American and European stations are heard clearly on short wave and from Lisbon on medium wave also. In 1940 about 1,400 receiving sets were in use on Madeira, but listening is not likely to spread much as there is no electricity in most of the rural districts and the mass of the people cannot afford to buy receivers.

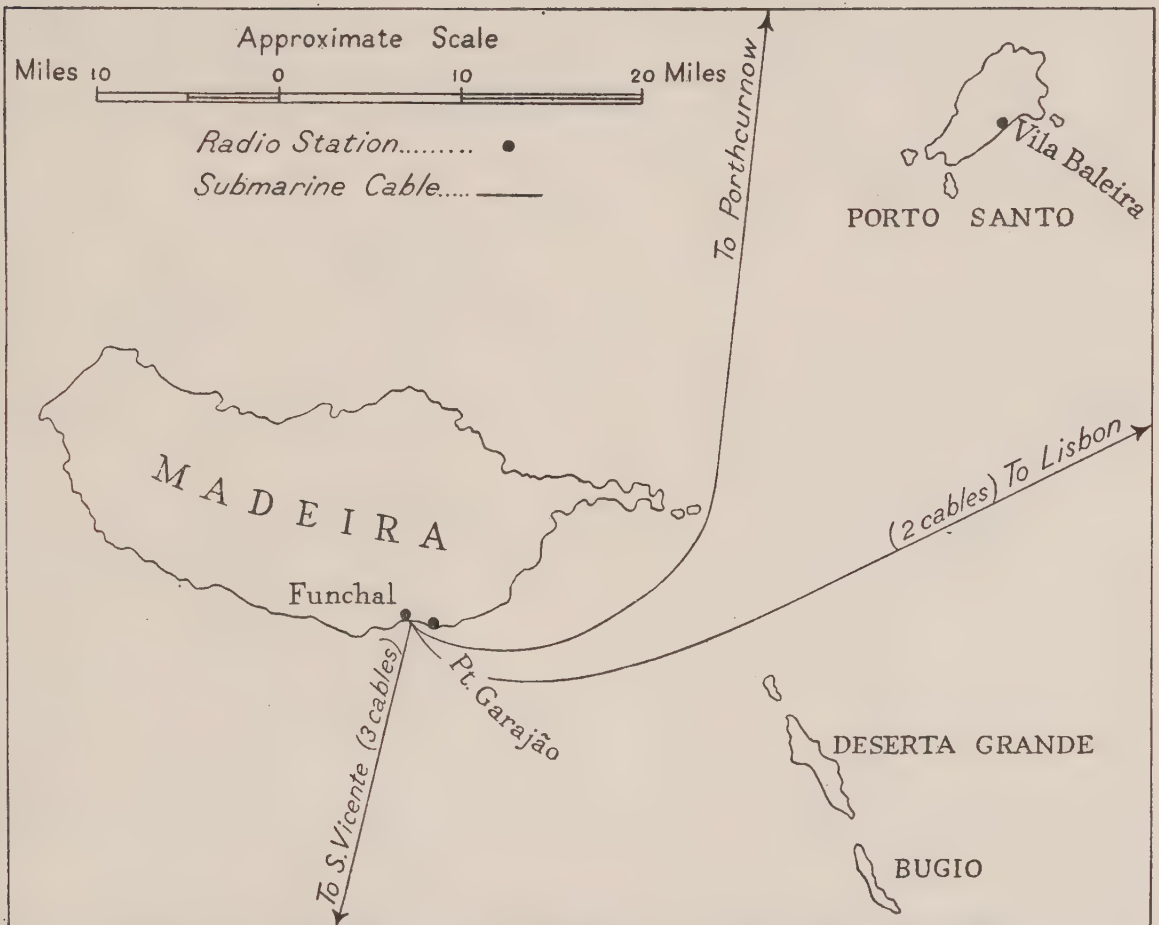


FIG. 15. *The Signal Communications of the Madeira Group*

THE AZORES

Telephone and Telegraph

There is reported to be a government-owned telephone system of limited extent on the islands of S. Miguel, Fayal, Terceira, and Pico. On S. Miguel the service consists of local calls within the Ponta Delgada township; on Fayal there is only a military exchange, with connexions to the Guia peninsula in the south, to near Cedros in the north, and Capelinhos lighthouse in the west. On Terceira, Angra do Heroismo is linked up with the other main towns of the island, while on Pico a line runs from Lagens to Piedade on the east.

The only land telegraph facilities on the Azores appear to be on the islands of S. Miguel, Fayal, and Pico. On S. Miguel nearly all the villages and towns on the main north and south roads of the island are connected by a land-line to the head office at Ponta Delgada. On Pico only the towns of Lagens, Magdalena, and Caes are served by telegraph.

Submarine Cables

Horta on Fayal is one of the world's greatest cable centres, being the focus of fifteen trans-Atlantic lines which link it directly to three continents (Fig. 16). Details of the international cables are given in the following table:

<i>From</i>	<i>To</i>	<i>Number of cables</i>	<i>Approximate distance in nautical miles</i>	<i>Operating company</i>
Horta	Porthcurnow, Cornwall	2	1,350	Cable & Wireless, Ltd.
"	Carcavelos, Portugal (<i>via</i>	1	1,060	"
"	Ponta Delgada)			
"	S. Vicente (Cape Verdes)	1	1,466	"
"	Halifax, Nova Scotia	1	1,898	"
"	*Málaga, Spain	1	1,338	Italian Cable Co.
"	Rockaway Beach, New York	1	2,360	Western Union Tele- graph Co.
"	Bay Roberts, Newfoundland	1	1,341	"
"	Canso, Nova Scotia	2	1,710	Commercial Cable Co.
"	Waterville, Eire	2	1,225	"
"	*Brest, France	1	1,190	French or German (un- decided)
"	Coney Island, New York	1	2,290	" " "
"	*Borkum, Germany	1	1,884	German Cable Co.

The cables (marked *) to Spain, France, and Germany were cut late in 1939, but the first of these (to Málaga) has been restored to use between Horta and Gibraltar and is operated by Cable and Wireless Ltd. At Horta the six companies named in the list function separately from a single cable station which was built in 1930 to a design considered to be earthquake proof. The cables land at Horta either on the beach near Forte de Lagoa on the north coast of the bay or at Porto Pim (Fig. 55).

The main islands of the Azores are linked together by a local system of cables, owned by the Portuguese Government. The Fayal (Horta)–S. Miguel (Ponta Delgada) cable is part of the Horta–Lisbon line; the other cables run from Horta to Areia Larga (Pico), from Prainha (Pico) to Vila de Vellas (S. Jorge) and to Angra do Heroísmo (Terceira),

and from Caldeira do S. Christo (S. Jorge) to Praya (Graciosa). In June 1941 only the inter-island cable-service between Horta (Fayal) and Ponta Delgada (S. Miguel) was still in operation.

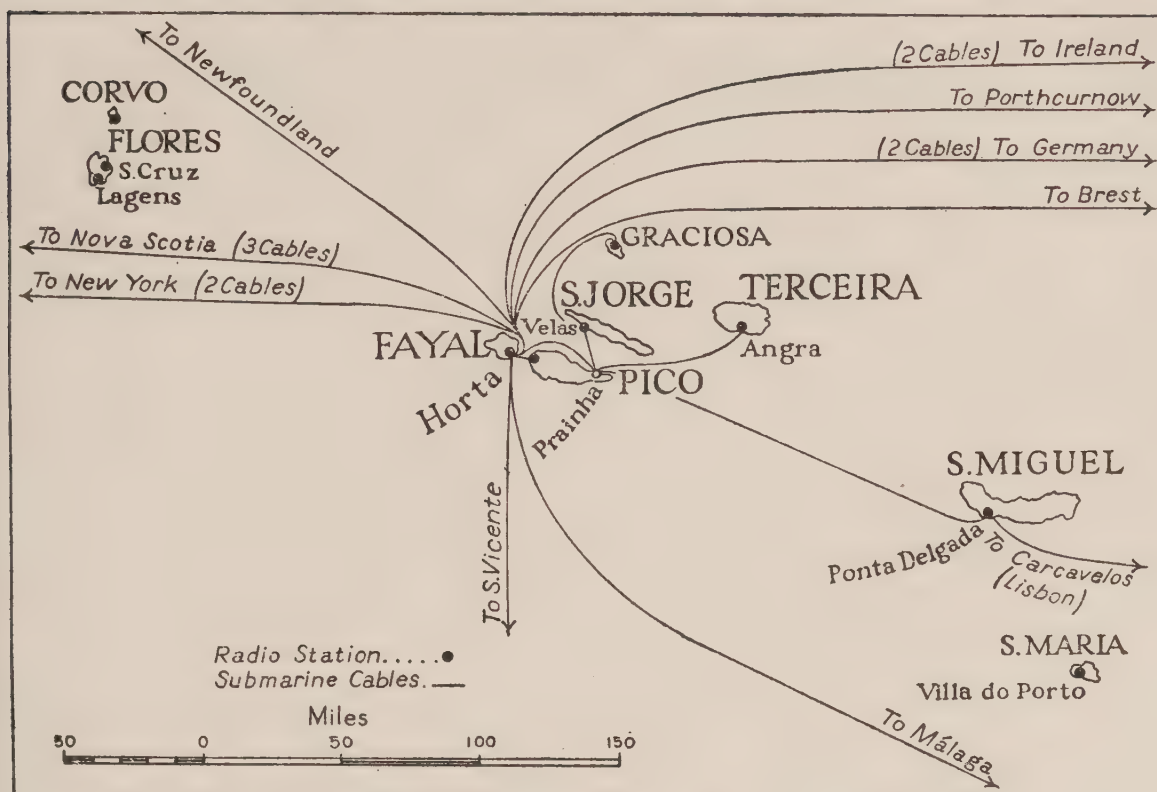


FIG. 16. *The Signals Communications of the Azores*

Wireless Telegraphy, Telephony, and Broadcasting

For commercial and private communications the Post office department of the Portuguese Government operates a public-service radio station on each of the nine islands of the Azores. In addition, the Portuguese Navy Department, through the agency of Radio-Telegraph Marine mainland stations on Fayal and Flores which are used exclusively for official purposes, and the Cia. Portuguesa Radio-Marconi, a private concern, operates a station on S. Miguel. The position and relevant details of the wireless (W/T) and radio (R/T) stations in the Azores are given in Appendix D.

Broadcasting is little developed in this archipelago. Before the closure brought about by the Government ban of September 1939, a commercial broadcasting station was operating from Ponta Delgada on S. Miguel. There seems to have been no other station of this nature in the Azores. Reception on medium and long wave is usually possible only during darkness, but short-wave reception from Europe and the Atlantic seaboard of the United States is good. In 1941 about 1,800 receiving sets were in use in the archipelago.

PART II

DETAILED DESCRIPTION

CHAPTER X

THE CANARIES

THE Canary archipelago consists of seven main islands and six insignificant islets. The approximate area and population of the islands are given in the following table (Fig. 17).

<i>Island</i>	<i>Area in square miles</i>	<i>Population in 1930</i>
Gran Canaria . . .	634	219,922
Tenerife	919	224,329
Gomera	172	26,703
La Palma	318	48,620
Hierro	120	8,071
Fuerteventura . . .	670	13,629
Lanzarote	280	25,325



FIG. 17. *The Canaries*

The islands can be divided into three groups. The first or central group consists of the two large islands of Gran Canaria and Tenerife, by far the most important in the archipelago and containing 80 per cent. of its total population. The towns of Las Palmas and Santa Cruz with their useful harbours are situated on these islands.

The second or western group consists of Gomera and Hierro and the larger island of La Palma. The latter is the most important island in the archipelago after Gran Canaria and Tenerife.

The third or eastern group, which is the nearest to the African mainland, consists of the two large islands of Fuerteventura and Lanzarote, together with the small islets in their vicinity. The eastern group has no perennial streams and conditions are almost Saharan, lack of rain sometimes causing much distress. In spite of their considerable size these two islands possess relatively little economic significance.

The difference between the physical characteristics of the eastern and those of the other two groups is emphasized by the relative heights of the summits of the various islands, given in the following table.

<i>Island</i>	<i>Summit height in feet</i>
Tenerife	12,162
La Palma	7,746
Gran Canaria	6,483
Hierro	5,725
Gomera	4,869
Fuerteventura	2,750
Lanzarote	2,247

The Canary islands were known to the Romans as the Fortunate islands; the name 'Canary' is said to be derived from a local breed of large dogs. This group of islands played an important part in the great age of exploration. Columbus started from the Canaries on each of his four famous voyages.

As no railways have been built on any of the islands and as there are no navigable waterways, the only means of transport is by roads and tracks. On most of the islands the mileage of good roads is small, but is increasing on Gran Canaria, Tenerife, and La Palma. Local coastal steamers are used to supplement the inadequate road system.

The Canary islands have three distinct economic functions. They are an important fuelling station for ships and aircraft, a rich centre for the production and export of certain fruits and vegetables, notably bananas and tomatoes, and a resort for tourists. In the development of all these functions the United Kingdom has played a considerable part.



FIG. 18. *Relief of Gran Canaria*

Relief shown by contours at 200-metre intervals. The 50-metre contour above sea-level is also given

GRAN CANARIA

PHYSICAL GEOGRAPHY

Relief

The island of Gran Canaria (Grand Canary) stretches for $34\frac{1}{2}$ miles from north to south and 29 miles from east to west and covers an area of 634 square miles. In shape it is circular; in form it closely resembles an inverted saucer or a flattened dome. This volcanic mass culminates in the Cumbres, a swelling upland, for the most part an arid expanse of loose stones and rock, which just exceeds 6,400 feet in the Pico de los Pechos (Fig. 18).

The slopes of the dome are deeply furrowed by barrancos, or gorge-like valleys, which radiate from the Cumbres. Some of the barrancos, and especially those in the north and north-east, are merely deep, narrow gashes in the mountain side; others originate in enormous, steep-walled amphitheatres that contract seawards into vast canyons. The greatest head-combes and deepest barrancos are found on the southern and western slopes of the island. The largest of the ravines is the barranco de Tejeda, which when seen from Tenerife appears to split the dome in two; the barrancos of Arguineguin, Fataga, and Tirajana are also very large (Photo. 25).

The surface of the island is further broken by protruding volcanic knolls and by isolated subsidiary cones. The chief upstanding masses of rock are the Roque del Saucillo, the Roque de Bentayga, and the Roque Nublo (6,100 ft.), all of which rise precipitously a few hundred feet above the Cumbres upland (Photo. 27). Among the isolated cones of the periphery are Montaña de Gáldar (1,533 ft.), the Caldera de Bandama, and the headland of La Isleta. The Caldera de Bandama (1,840 ft.; 7 miles SW. of Las Palmas) has a remarkable crater, over one thousand yards across, the floor of which has subsided several hundred feet leaving the precipitous enclosing walls intact. La Isleta is a small cluster of volcanic hills forming a peninsula that rises in the north to 787 feet in Morro de la Vieja and sinks in the south to the low, narrow spit of sand at Puerto de la Luz.

The area of lowland and plain in Gran Canaria is relatively small. Between the numerous barrancos on the western side of the island great ribs and buttresses of rock often extend as far as the sea, where they terminate in tremendous cliffs. In this wild mountainous country the only patches of flat land are the small sandy beaches at the mouths of some of the barrancos. The north of the island is less

ugged and is low but hilly near Gáldar. However, the only extensive plains in Gran Canaria are confined to the coastal areas of the east and south. These lowlands begin south of Telde (Photo. 26) and stretch with a width of 2 to 4 miles as far as Carrizal. Beyond this village the plain opens out and maintains a width of 4 to 6 miles (below 750 ft.) almost to Juan Grande. The surface is mostly barren, being covered with stones and occasional lumps of lava, and is crossed by the barrancos of Guayadaque, Polvo, and Tirajana. On the landward side the plain ends abruptly at the steep volcanic slopes of the dome. West of Juan Grande the lowland contracts into a narrow coastal strip which in parts is broken by the fan-like spurs of the Cumbre de Amurga. The plain reappears, however, farther west about the mouth of the barranco de Fataga, where the *charco* of Maspalomas forms the nearest approach to marsh in the Canary Islands. The *charco* is a 3- to 4-mile stretch of flat marshy ground, dotted with pools of almost stagnant water, the banks of which are thickly overgrown with bushes and grasses. For much of the year the region has no rainfall, but in times of heavy rain the barrancos carry rushing torrents which turn the marsh into a veritable swamp. This area is bounded on the east and south by sands and sand-dunes; on the west it merges into the stony plain stretching to Arguineguin.



FIG. 19. *Gran Canaria from the South-east with Peak of Tenerife in distance*

Drainage and Water-supply

The numerous barrancos of Gran Canaria are all dry except after heavy rain which may not happen for periods of 2 or 3 years. It should be observed that there is a remote possibility of damage and danger from sudden flood.

In the absence of perennial streams, the inhabitants obtain their water-supply entirely from surface springs and underground sources. Springs are plentiful especially in the hills above Telde and Arucas and in the upper courses of the main barrancos. In periods of rain springs abound in the mountainous west and not uncommonly break out on the precipitous flanks of the canyons; in time of drought only the main springs persist. Las Palmas and Puerto de La Luz obtain a piped supply from springs near the Roque del Saucillo (at 5,250 ft.).

The water gravitates to the main covered reservoir near Las Palmas, where a supplementary pipe enters from the Carrizal area. The supply just suffices, except in time of prolonged drought when severe rationing is necessary.

Gran Canaria is well provided with mineral springs, some of which are palatable; the chief of these are in the barranco de las Madres near Firgas, in the barranco de la Fuente Agria near Teror, and near Fuente Santa, Los Osorios, and Agaete.

Open-air tanks or reservoirs, which provide water for irrigation, are built in all the inhabited areas of Gran Canaria. They are fed by *acequias*, or artificial channels, which lead the water direct from the springs to be stored for summer use. These tanks vary in size from small pools dammed by earthen embankments to the great cement-lined reservoir west of Arucas, where massive walls of stone 89 feet high enclose a body of water 555 yards long, with a capacity of 100 million gallons. The main feeders of this reservoir are the springs in the hills near Valleseco.

The tapping of underground water is done by means of wells and horizontal borings and tunnels. Wells are especially common on the coastal area south of Telde as well as near Sardina and in the barranco de Fataga. Some of those near the south coast of the island, as in the neighbourhood of Juan Grande and Maspalomas, are brackish, but, as a general rule, shafts sunk into the beds of the barrancos here and elsewhere yield excellent drinking-water.

Vegetation

The vertical distribution of vegetation in Gran Canaria consists roughly of four zones: the arid maritime zone from sea-level to 1,000 feet; the Monte Verde or cultivated zone from 1,000 to 3,000 feet; the pine-forest zone from 3,000 to 4,000 feet, and the Cumbres zone from 4,000 to 6,400 feet. However, the activities of man have interfered so much with this zonal arrangement that it often does not coincide with the actual distribution of vegetation. There are to-day five main vegetation areas in Gran Canaria (Fig. 20).

I. *The Semi-arid Plains of the South-east.* This flattish, semi-desert area stretches from the neighbourhood of Telde south-westwards to Arguineguin. It lies between sea-level and 1,000 feet, and its flora is characterized by the *Euphorbia* and *Opuntia*, both of which thrive in the most barren-looking places. An outlying strip of the same arid, shrub-dotted nature occurs between Gáldar and Agaete in the north-western part of the island.

The desert-like plains of the south-east include the charco, a small district of sand-dunes and periodically flooded watercourses, the banks of which are overgrown with low tamarisk bushes, coarse spiky grass, a species of rush, and several water plants.

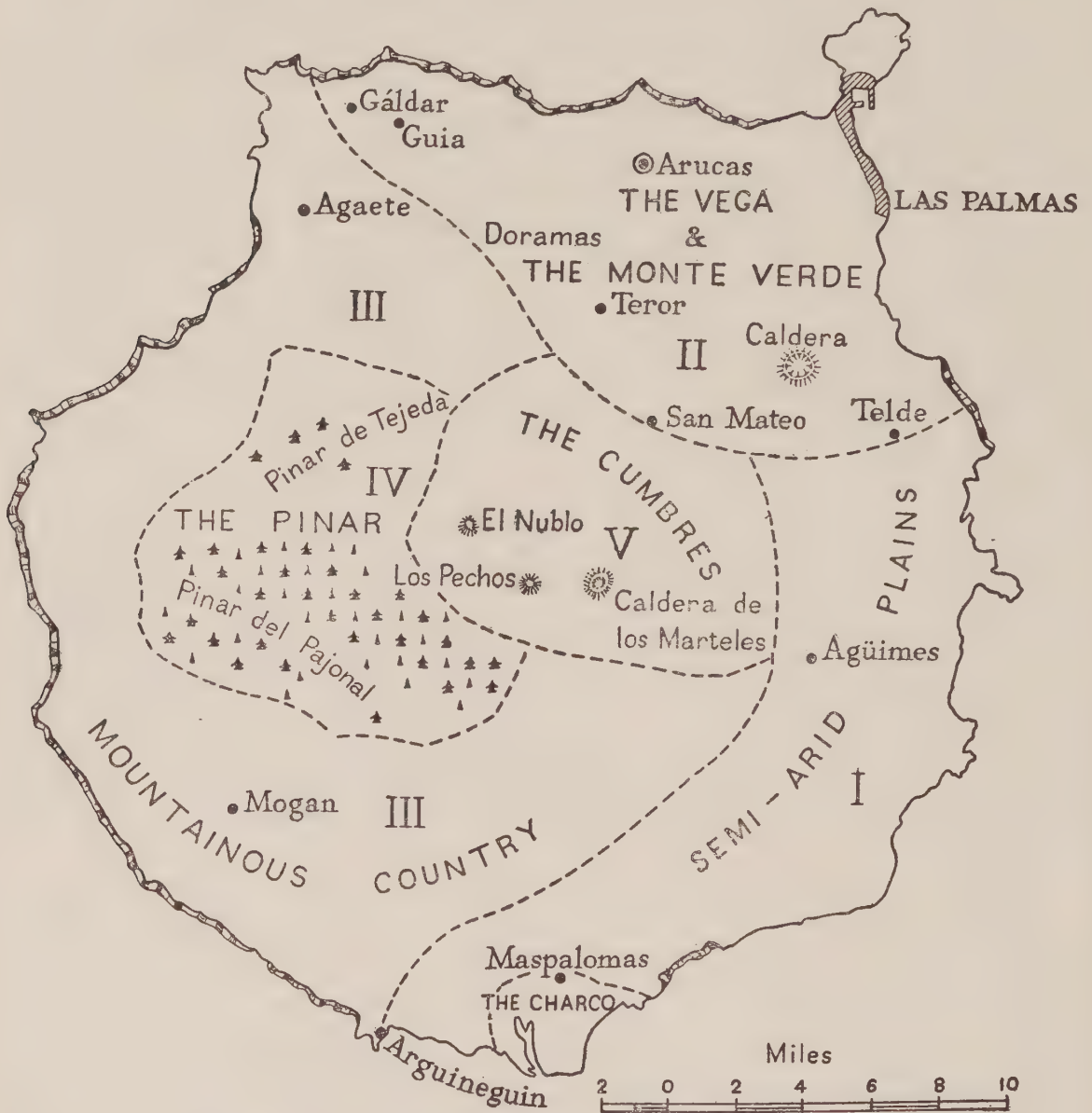


FIG. 20. *Vegetation Regions of Gran Canaria*

II. *The Vega and the Monte Verde.* The Vega consists of the irrigated lowland strips of northern and north-eastern Gran Canaria; the Monte Verde is the zone of cultivation at 1,000 to 3,000 feet, including the remnants of the ancient chestnut and laurel forest at 1,400 to 2,700 feet. These highly cultivated districts on the northern slopes of the island stretch from Telde to S. Mateo, Teror, Firgas, and Gáldar. Here vines clothe many of the hill-sides, while loquats, pomegranates, guavas, mangoes, peaches, oranges, and bananas grow

in profusion. Sugar-cane is grown extensively, and in every respect this is the most luxuriant region of the island.

Remnants of the former magnificent chestnut forest occur near S. Mateo, Teror, and Los Osorios, while patches of laurel survive near Doramas and S. Brigida.

III. *The Mountainous Country of the South and West.* The lower slopes of the Cumbres dome rise precipitously from the sea and are deeply dissected by great barrancos. In this wild, rugged area a thin covering of shrubs, such as *Cistus*, occurs on the ridges, especially inland from Aldea. The floors of the barrancos, apart from the pebbly beds of the watercourses, are often overgrown with *Euphorbias*, *Plocama pendula*, and other shrubs; the barranco-sides may carry an indigenous vegetation of miniature Dragon-trees, *Euphorbias*, and rosette-like members of *Sempervivum*. Everywhere, however, the plant-cover is broken by steep or precipitous faces of rock.

IV. *The Pinar or Pine-forest Area.* Once much more extensive, the pine forest now lies at 3,000 to 4,000 feet on the west and south-west slopes only of the Cumbres. North of a line from Agaete to Roque Nublo and Tirajana hardly a pine (*Pinus canariensis*) remains; south of this line the ridges and spurs are sparingly covered. The trees grow over a large area, but they are nowhere thick. No attempts have been made to plant new growth, and as goats destroy the young seedlings the forest area seems likely to go on decreasing.

V. *The Cumbres Area.* The rocky, boulder-strewn summit of Gran Canaria has very little vegetation. On the flat tableland of the Cumbres above 5,650 feet scattered bushes of *Euphorbia* and of a few other shrubs appear amid barren stretches of loose stones and boulders, but there is no semblance of a well-defined belt of fodder plants such as occurs on the higher flanks of the island of Tenerife.

Coasts

Gran Canaria has a fairly regular outline, except for the prominent peninsula of La Isleta, off the north-east coast. The Puerto de la Luz, the best harbour in the Canaries, has been built in the shelter of La Isleta and is the port of Las Palmas, the capital of the island. The other parts of the coast, though in places precipitous, are not inaccessible, except in the south-west. The ports other than La Luz are mere roadsteads with small beaches, some with short moles, which are unapproachable when the surf is heavy.

On the eastern coast from Las Palmas to Punta de Gando, a distance of 14 miles, headlands and sandy beaches alternate, the cliffs

being rugged but low. The most northerly of the beaches is that at La Laja, where a gently shelving stretch of sand lies at the foot of abrupt cliffs, the main Las Palmas-Telde road running along the edge of the beach and passing through a narrow tunnel under Punta del Palo. There are one or two scattered houses near the shore, but no village. South of La Laja the beach of Jinamar is formed by the seaward edge of a stream of lava and scoriae; from the mouth of a small stream entering the beach a track leads inland across desolate country to the main road at Lomo Jinamar (about $1\frac{1}{4}$ miles). Cliffs extend to Punta Melenara, which is fronted by a line of rocks above and below water, about 600 yards long. South of the point a sandy beach opens out at the mouth of the barranco de Silva and there is anchorage in 11-14 fathoms in the north of the bay, which is joined by tracks to Telde and Gando airport. A similar beach about three-quarters of a mile long lies between Punta del Ojo and Punta del Ambar and is surrounded by low cliffs.

The bay of Gando, 6 miles long between the headlands of Gando and Arinaga, has steep cliffs on its northern side, but on the west there is an almost continuous sandy and pebbly beach broken by the wide mouth of the barranco de Guayadaque. The best anchorage is near the northern end of the bay; a few houses are built on the shore, while the quarantine station and Gando airport lie across the headland. About half a mile north-east of Punta de Gando there is a dangerous steep-sided reef about 150 feet long which is not always marked by surf.

An arid, sparsely peopled coastal plain from 2 to 5 miles wide, which narrows towards the south, forms the hinterland between Punta de Arinaga and Playa del Cardón, the only height near the shore being the Montaña de Arinaga which overlooks the bay of that name. South of Punta de Arinaga the small bay of Arinaga, with a mole built from its north-eastern edge, has a clear entrance but shallow water. A hamlet lies on the shore, connected by a secondary road to Agüimes 5 miles to the west. The broad opening of the barranco de Tirajana has a landing-place on its northern bank at Puerto Tenefé, from which fishing-boats load salt from the neighbouring salt-pans, and this is succeeded by a straight low stretch of coast sloping to the south-west. A pebble beach forms the Playa del Cardón, where the main south road again runs parallel with the coast.

A gentle southward curve leads from the Playa del Cardón to Punta de Maspalomas, the low sandy headland backed by scrub-covered dunes which is the southern termination of the island.



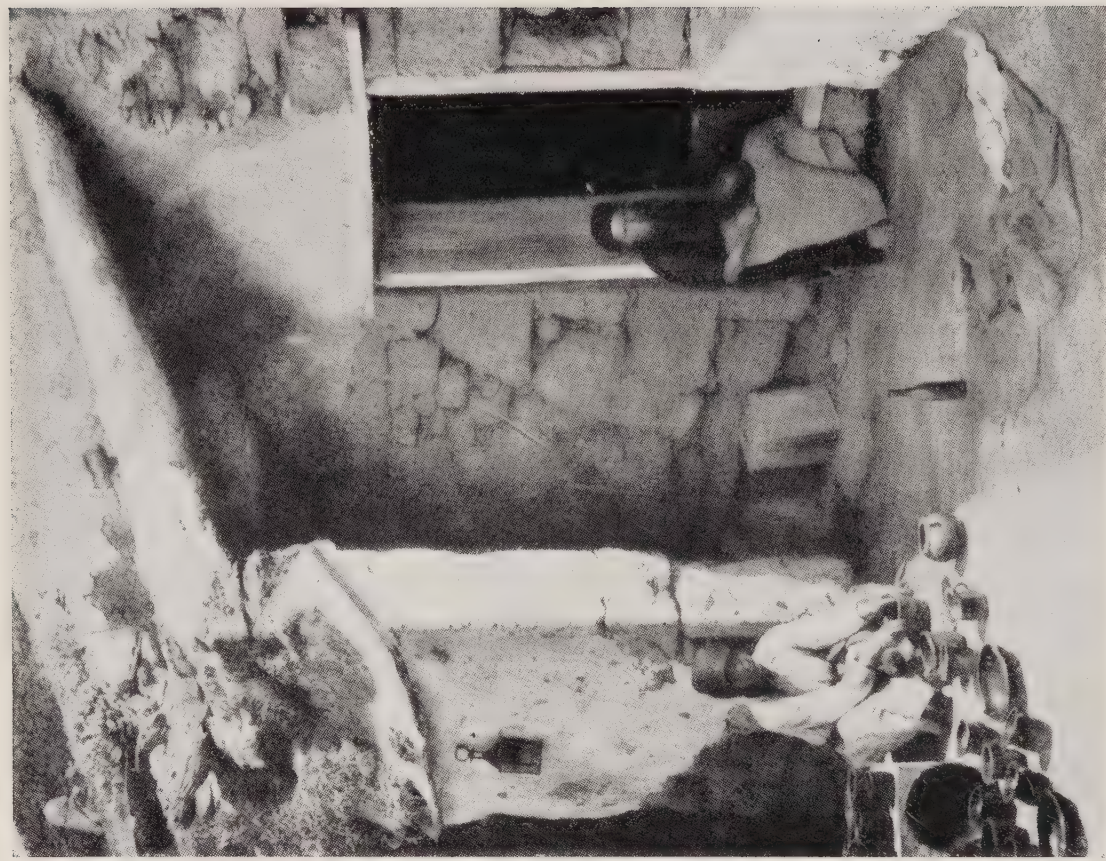
25. *Barranco de Tirajana at S. Bartolomé*



26. *The Telde valley*



27. Roque Nublo, Gran Canaria



28. Peasant's house, Gran Canaria

Although the beach is about 4 miles long, the hinterland is very soft in places, and marshy lagoons occupy much of the area. West of the mouth of the barranco de Fataga there is an anchorage in 7 fathoms with a sandy bottom, exposed to frequent squalls, and a track leads to the main road in about 1 mile. At the western end of the marshy country lies the fishing-village of Arguineguin which has grown up at the mouth of the barranco of the same name. There is a good anchorage in $5\frac{1}{2}$ fathoms, and landing is possible on the pebbly beach in front of the village (Photo. 29).

The 22 miles of coast in the south-west and west from Arguineguin to Paso del Herrero are formed by inhospitable cliffs rising sheer from the sea, cut up by many steep-sided barranco valleys. In good weather the fruit-boats call at the roadstead of Puerto de Mogán, where a masonry mole has been built from a stony beach. The next landing-place is 15 miles from Puerto de Mogán. Here another mole, lying in the shelter of Paso del Herrero, serves as a port for Aldea de S. Nicolas, to which it is connected by a road about $1\frac{1}{2}$ miles long.

The north-western coast, 15 miles long to Punta Roque Negro, drops in height from south to north. The cliff scenery to Puerto de las Nieves is impressive, as the land rises abruptly from the sea to mountains such as Montaña de Tirma at 3,200 feet, within 1 mile. The mountain crags are carved into strange shapes and the towering summits are thinly covered with pine-trees. A motorable road is reported to have been completed from Aldea along the edge of the cliffs to Agaete. Landing is not possible until Puerto de las Nieves is reached, where a small mole has been built in the north of the bay between Punta Gorda and Punta Tamadaba; this is the outlet for the fertile barranco of Agaete, and is joined to the main north coast road. Several bays lie to the north, the most approachable being the Rada Sardina, a small, rocky, and cliff-bound cove sheltered by Punta Roque Negro.

The northern coast is somewhat more accessible than the western, having lower cliffs and several bays with deep water close inshore. As the anchorages, however, are exposed to the prevailing winds they can be dangerous. Many villages lie on or near the coast, and the main north road runs roughly parallel but up to $3\frac{1}{2}$ miles inland. The western anchorage is in the bay of Gáldar, dominated by a conspicuous hill to the south-east 1,476 feet high. A small mole is used by fishing-vessels. Landing is possible, but not easy, at Bañaderos (Photo. 30), where the road lies immediately behind the coast. In the east Confital bay opens out between Punta de la Rosa and the isthmus

of La Luz; the landing-places lie between the reefs at its head and can be used only by small boats, as the water is not deep inshore. There are tracks running parallel with the bay to La Luz, and the road from Tamaraceite to La Luz touches its eastern shore.

The north-eastern corner of the island formed by La Isleta, the isthmus on which La Luz stands, and the sandy beach of Las Palmas, is the most prosperous and densely peopled part of the coast. The harbour of La Luz has been built on the eastern side of the sandy isthmus in the shelter of El Nido, the eastern headland of La Isleta (p. 134). The houses of La Luz are packed tightly on the lower slopes of the peninsula and across the isthmus; main roads run thence into the city of Las Palmas which expands over the beach stretching to the south.

HUMAN GEOGRAPHY

Distribution of Population

In 1930 the total population of Gran Canaria was 219,922, or only about 4,000 less than that of Tenerife. Consequently it has the highest density population in the Canaries, there being 347 people to the square mile. Rather more than one-third of the total inhabitants live in the small north-eastern corner around Las Palmas, and there are no other towns of any size. The settlements are often loosely grouped entities, and the houses are usually strung along some large barranco. In the south, where the scarcity of water becomes more serious, the villages are usually small and compact (Fig. 22).

Though stone-cutting is better understood here than in the other islands of the Canaries, and some good basalts are available, the peasant house is usually a very simply built whitewashed box sometimes with a sloping, sometimes with a flat roof (Photo. 28). Caves are still used as dwelling-places, especially in the mountains.

Las Palmas Area. There are 78,176 inhabitants in the district of Las Palmas, almost all of whom live in the city of Las Palmas or in the town of Puerto de la Luz, which is contiguous with Las Palmas and stretches along the isthmus to La Isleta.

There is no cluster of satellite villages or small towns nearby; the farming people who live outside the capital inhabit small whitewashed houses scattered amongst the banana groves, which are closest together where the running acequias give most promise of cultivation. The hinterland of Las Palmas itself is not particularly fertile, low sandhills stretching away to the west, and the monotonous



29. *Arguineguin*



30. *Coast of Gran Canaria at Bañaderos*



31. *Gáldar*



32. *Arucas*

dull green of banana plantations extending along the coast and inland up the barranco de Guiniguada.

Northern Coastal Valleys. A stretch of country along the north coast about 6 miles wide is one of the most densely peopled areas in the Canaries. This north coastal region is, however, a succession of steep-sided mountains and deeply cut barrancos so that the settlements are very unevenly spaced. It is mainly due to the relative abundance of water for irrigation that the population reaches about 62,800.

The actual coastline is formed by high cliffs, and the hamlets built in the small bays owe their existence mainly as outlets for the fruit trade. Bañaderos, Sardina, and Puerto de las Nieves are built above small beaches. The main zone of settlement is a belt of country between 1 and 3 miles from the coast, where many of the larger villages lie along the north coast road on the lower reaches of barrancos. Farther inland the houses are much more scattered, and only here and there do they coalesce and form a hamlet. The greater height of the mountains and the distance from good roads tend to restrict settlement even more markedly to the larger valleys.

The typical landscape of the north coast, with its wealth of cultivated vegetation extended by every possible method of terracing and irrigation, begins to appear at Tamaraceite. Banana plantations, with occasional fields of sugar-cane and tufts of palm-trees, surround the villages. The mountains rise steeply to between 1,000 and 2,000 feet within 2 or 3 miles of the shore, their upper slopes having a scanty population, employed mainly in utilizing the poor pastures for goats and a few sheep. Arucas, which with its district has a population of 17,236 (the second greatest in the island), is the first important settlement west of Las Palmas. It lies at the foot of the Montaña de Arucas and north of the bed of a large barranco. Sugar-cane fields surround the town, which has developed an important local market. The houses are grouped compactly around a conspicuous grey stone church, but some stretch out to the south-west towards the hamlet of La Goleta (Photo. 32).

Every piece of level land is occupied by isolated houses or hamlets in the countryside between Arucas and Gáldar. Near the coast, Bañaderos and Trapiche share the water of one barranco, whilst S. Felipe and Moya share that of another. Moya with its district has a population of over 7,000 and is surrounded by an oasis of almond, apple, and chestnut trees interspersed with fields of potatoes and maize. Firgas to the south-east lies above a deeply scored valley,

where laurels, poplars, and fruit-trees almost conceal the white-washed cottages. About 3 miles farther into the mountains, and almost enclosed by them, stands Teror with its fifteenth-century church and atmosphere of old-world Spanish life. It has the advantage of abundant water-supplies and is used as a summer resort.

The barranco de Gáldar provides sufficient water for two large villages, Gáldar and Guia, whilst numerous hamlets also lie along its tributaries and near its source. Gáldar commands a district of 10,111 inhabitants and spreads over the plain between the cinder cone of the Montaña de Gáldar and the barranco (Photo. 31). The countryside here is extremely fertile irrigated land, producing mainly sugar-cane and bananas. Guia, which lies only 1 mile farther inland, is the head of a district with over 8,000 inhabitants.

The population thins out very markedly in the north-west corner of the island between Gáldar and Agaete, partly because the land is more broken and exposed to winds, and partly owing to the smaller number of streams. Agaete, however, commands another typical valley, its slopes rising abruptly in the south to 3,280 feet. The valley is closely settled up to 1,000 feet, and sugar plantations and stock-raising provide employment for a district with about 4,000 inhabitants. Agaete itself is a large village on the main road about 1 mile from the sea; its outlet is the hamlet of Puerto de las Nieves, which sends butter and oranges across to Santa Cruz de Tenerife. The region of dense settlement abruptly terminates at Agaete, and the isolated mountains of the west coast block the way to the south.

Eastern Coastal Area. In the area between Las Palmas and the barranco de Tirajana, which extends for roughly 6 miles inland, there are about 52,600 people. The distribution of settlement is by no means homogeneous, the villages avoiding the country within 3 miles of the coast, and concentrating in the valleys of the Guiniguada, Telde, and Agüimes barrancos. The shortage of water is far more acute than on the north coast and becomes progressively worse towards the south.

Numerous small towns and villages crowd along the barranco de Guiniguada, which leads from Las Palmas to the foot of the Cumbres. Most of the houses are built below 2,000 feet, for the mountain slopes rise very abruptly above the valley. The barranco is followed from Las Palmas by the main central road which is lined with houses almost to Tafira. Tafira itself is in a most fertile district, surrounded

by vineyards, fig, peach, and almond orchards. S. Lorenzo is a second large village here to the north of the Guiniguada, the centre of a district with 14,793 inhabitants.

The stretch of the valley between Tafira and S. Brigida in the Monte provides a cool refuge in summer for many of the citizens and visitors of Las Palmas. As the valley rises, the countryside becomes greener and has many vineyards. S. Brigida, the principal settlement of a district with 6,600 inhabitants, is mainly a tourist centre for visitors going into the Cumbres. The village lies on a spur at 1,570 feet between the main barranco (which has here changed its name to Angostura) and a tributary which runs parallel to the south. The village itself has little cohesion, the houses being scattered over the level patches of ground, and it appears from the road encircled by mountains. Above S. Brigida the settlements lie above 2,400 feet; and their distribution is discussed on p. 129.

A sparsely peopled area of country separates the valleys of Guiniguada and Telde. South of Las Palmas there are very few houses near the coast; the largest hamlet is Lomo Jinamar, a desolate group of houses about half a mile inland at the foot of the black Caldera de Bandama. La Atalaya, one of the most interesting villages in the Canaries, lies to the west of this Caldera. It is almost entirely a troglodyte settlement, the caves being carved out of a hill which rises steeply from the barranco de las Goteras. The inhabitants are employed in making pottery, fashioning clay round large stones without using a wheel according to the Guanche custom. The whole area is in striking contrast to the green luxuriance of the Monte or the valleys of the north coast.

The barranco Real de Telde has a pattern of settlement similar to that along the Guiniguada. The houses are spread over a gently sloping plain between low cliffs and the southern bank of the barranco. Telde itself is a sprawling town which has grown up along the main road; it is the centre of the third most populous district in the island with over 16,500 inhabitants, who cultivate bananas and oranges of especially high quality. With its palm-trees, dome-shaped church towers, and flat-roofed houses Telde looks strikingly like a small town in Morocco. Farther up the valley the houses are more scattered, and Lomo Listón is the only village of importance.

An almost barren and waterless plain about 5 miles long and $2\frac{1}{2}$ miles wide stretches south towards Agüimes. Small hamlets are grouped at the head of Melenara bay and north of Gando bay.

The villages of Agüimes, Ingenio, and Carrizal depend on the

barranco de Agüimes and have together a population of about 9,500. Ingenio, which lies on tributaries of the main valley, was one of the earliest centres of sugar production in the archipelago. Agüimes stands on a windy plateau, the clock-tower of the church shaped strangely like a mosque. There is far less scattered settlement here than on the richer valleys of the north.

Sardina, near the Tirajana valley, is the only village south of Agüimes, and is surrounded by an arid plain.

Southern Coastal Strip. The lowland fringe along the south coast suffers acutely from a scarcity of water, and the plain that stretches between the sea and the hills is sandy and unfertile.

South of the barranco de Tirajana the first village on the main road is Juan Grande, its palm-trees making it conspicuous from afar. The arid plain extending thence to Maspalomas village is practically deserted. Maspalomas itself is built at the foot of the hills, to avoid the coast and the marshy country near the Fataga barranco. To the west is the village of Arguineguin, which lies on both sides of a wide estuary; it is a small fishing settlement on a sheltered beach and was, in fact, one of the anchorages mentioned by Bethencourt's men on their first visit to Gran Canaria.

Western Coastal Area. The wild valleys and precipitous mountain slopes from Arguineguin to Agaete have very few inhabitants owing to the lack of level land and the extreme difficulty of building roads, either along the coast or across the Cumbres. The fruit produced in the valleys is carried with much labour down to small beaches such as that at Mogán, and taken away by fruit-boats when the surf is not too heavy.

In the south-west the village of Mogán commands a district with only 1,484 inhabitants; it consists of a long line of houses about 5 miles inland strung along the valley of the Mogán, where bananas and tomatoes are intensively cultivated. Farther north the mountains rise steeply between 2,300 and 2,800 feet within 2 miles of the coast, and the isolated hamlets are all situated at least 4 miles inland near the headstreams of the barrancos.

A thriving settlement has grown on the flat land in the lower valley of the Aldea, and Aldea de S. Nicolas with its district has over 3,400 inhabitants. The valley is divided into small prosperous farms, and the foodstuffs produced are exported from a mole built to the north of the barranco mouth.

Between S. Nicolas and Agaete the mountains again prevent any continuous settlement, though a recently built motorable road will

doubtless open up the area. The hamlets of Tirma, El Risco, and Guayera consist of isolated farms, dependent on a few goats and small scattered fields.

The Cumbres Area. There is at first no marked diminution of population in the outer fringes of the central mountains, which have the advantages of cooler summer weather and increased water-supply. In fact, a semicircle of country from 2 to 3 miles wide around the Cumbres contains several of the larger villages in the island, such as Tejeda, S. Mateo, Valsequillo, S. Lucia, and S. Bartolomé. Settlement is by no means uniform, the mountains isolating the villages from one another, their only intercommunication being by mule-track.

In the north the larger mountain villages are Artenara and Tejeda, but there are also many scattered farms. Artenara lies at 4,600 feet above the sources of a barranco, the Montaña del Brezos rising precipitously on the west. It is the chief village in a very mountainous district with 1,207 inhabitants. The houses of Tejeda are scattered over the headstreams of a barranco at a height of 3,140 feet, amidst unusually fine mountain scenery. The village is the terminus of the main inland road from Las Palmas and the centre of a district with 3,542 inhabitants.

S. Mateo lies on the north-east at 2,670 feet and is the nearest village to the heart of the Cumbres. It is on the main road to Tejeda, and with its district has a population of 6,607. Valsequillo and Las Casillas are other villages to the east of the Cumbres, standing in the upper valley of the barranco which feeds Telde.

In the south there is a close concentration of villages and hamlets right to the foot of the Cumbres in the upper valleys of the Fataga and Tirajana barrancos. The neat houses of S. Bartolomé de Tirajana are grouped on the lower levels of a crater, shut in by steep-sided walls of basalt and trachyte which are riddled with caves. The soil is exceedingly fertile, and fruit-trees, particularly almonds and pears, grow in profusion. A ribbon of settlement follows the Tirajana barranco from Taidia to La Fortaleza, and some of the villages are inhabited by negro communities who originally came as slaves for the sugar plantations. S. Lucia is the largest village, its houses overshadowed by olive- and other fruit-trees, the barranco supplying fertile fields of tobacco, tomatoes, and bananas. The area has about 10,000 inhabitants.

The inhabitants of the few hamlets on the edge of the central Cumbres live mainly by pasturing goats on shrubs and bushes. The people are extremely poor, and many of them still dwell in caves.

Industries

Mining and Manufacturing. Mining and quarrying are unimportant in Gran Canaria, and manufacturing, apart from the processing of foodstuffs, is almost as insignificant. This is not surprising since the only source of motive force is a steam-turbine power-station on the southern shore of Confital bay. The manufacturing industries include shipbuilding and the making of cloth, drawn-linen work (*calado*), silk, cigars, baskets, and hats, but all except the first are domestic in nature and are carried on mainly by part-time women workers. Consequently, the chief industries of Gran Canaria are agriculture, fishing, and the fuelling and provisioning of ships. Of these the first greatly predominates.

Agriculture. If sufficient water is obtainable, the volcanic soils are usually fertile and will crop heavily year after year. Hence, in all the islands of the Canaries land-values vary with the amount of water available, first-class land with an assured supply being about 15 times as valuable as non-irrigable land and being worth between £1,500 and £3,000 per acre. Gran Canaria is the best provided of all the Canary islands in regard to irrigation water and has numerous storage tanks built either of stone with a lining of hydraulic cement or of earthen embankments upon a clayey base (Photo. 33). Most of the structures supply water to areas below 1,500 feet, since between this altitude and 3,500 feet rainfall is usually sufficient for agriculture.

In Gran Canaria the limit of cultivation is generally reached at 3,500 feet or 4,000 feet, above which aridity, difficulties of transport, and lack of soil-cover prohibit arable farming. Where water and soil are favourable, the following plants flourish in the various altitudinal zones:

From sea-level up to about 500 feet: date palm (in protected localities), papaya, and tamarind, with tomatoes as a winter crop on the north coast.

From sea-level up to about 1,000 feet: banana, sweet potato, gourd, arrowroot, cochineal, castor-oil, sugar, bamboo, cape-gooseberry, alligator pear, and custard apple, with potatoes (coastal areas) and tomatoes (south coast only) as winter crops.

From 1,000 feet up to about 2,000 feet: tobacco, tomato, all vegetables common in the British Isles, cereals, and fruits such as the mango, vine, orange, lemon, citron, almond, olive, fig, prickly pear, mulberry, pomegranate, peach, apricot, custard apple, guava, coffee, Japanese loquat, and melon.

From 2,000 feet up to about 4,000 feet: cereals, legumes, Spanish chestnut, hardier fruits such as apple and pear, and several of the plants of the zone below.

As a general rule, agricultural methods are primitive, the ox being the beast of labour and the heavy hoe the common hand implement. The plough is a beam with an iron point; for the threshing of small cereals oxen drag sledges studded with sharp pieces of basalt over a stone or paved floor; maize is separated by hand-machinery imported from the U.S.A.; the local farm cart is a solid two-wheeled vehicle capable of carrying about two tons.

Gran Canaria and the other islands of the Canaries are generally held in large estates, the land being let on the 'metayer' system. The tenant (*medianero*) is remunerated on a profit-sharing basis and has a form of tenant-right. The terms vary considerably, but usually the tenant receives a house and half the cost of the seed. The proprietor further bears half the expense of preparing and planting the seed-bed and of harvesting and marketing the crop, but he does not contribute to the cost of the intermediate labour. He also buys the live stock and half their fodder, taking in return half of the proceeds. He pays for repairs, provides two-thirds of the taxes, and must stand good for half of any losses. When land is sub-leased over the head of the *medianero*, the latter must be compensated for any improvements he has made.

The main crops on Gran Canaria are the banana, tomato, and potato. The following table of agricultural production in a normal year applies to Las Palmas province, which includes Gran Canaria, Fuerteventura, and Lanzarote. Since, however, the two latter islands are largely desert and semi-desert, it is safe to assume that the statistics of irrigable crops, fruits, roots, and meadows apply almost entirely to Gran Canaria. As will be shown later, much of the cereal acreage occurs in Fuerteventura.

Las Palmas Province, 1933

	<i>1,000 hectares</i>	<i>Value in million pesetas</i>
Cereals	23.0	6.25
Legumes	4.2	1.98
Roots, tubers, and bulbs	2.9	12.51
Industrial plants	0.38	1.31
Horticultural crops (irrigated)	1.67	16.75
Plantations	2.79	33.65
Vineyards	1.91	0.79
Olive-groves	0.09	0.09
Artificial meadows and forage crops	3.25	5.61
Pastures and rough grazing	116.6	1.75
Fallows and unplanted	26.1	0.47

The banana harvest is continual and yields on an average about 9 million bunches a year in the whole of the Canaries. Gran Canaria alone probably produces from $2\frac{1}{2}$ to 4 million bunches a year. The trees are only grown on irrigable land up to an altitude of about 800 feet; they take about 18 months to come into bearing and about 900 to 1,100 trunks, yielding a total of 560 to 600 bunches a year, are allowed to the acre. An average bunch (*racimo*) weighs 60 lb., but racimos of over 100 lb. with over 400 bananas have been known. After yielding one bunch, the trunk is cut down and future growth is on the suckers that spring up around the main stock. The most common variety grown in the Canaries is the Chinese banana (*Musa Cavendishii*), which will tolerate any soil except those very rich in sand or lime. The leaves of the tree form good manure and are used for packing, while the stems provide fodder for cows. The 2,790 hectares of plantations recorded in 1933—yielding crops worth 34 million pesetas or 40 per cent. of the total agricultural output—were given over almost entirely to the banana. The economic importance of the plant to the Canaries is incalculable. Not only is it the chief money crop, but the high value it gives to land has incited owners to do all in their power to find water, including the erection of pumping plant and the driving of long galleries into the hill-sides (Photo. 34).

Tomatoes also form a highly profitable crop, but they are more subject to disease than are bananas. Seeds imported from England are sown in August and September, and the plants pricked out, on irrigable land if possible, when about 6 inches high. The earliest fruit ripens by October and the latest in May or June. The bulk of the crop is exported to Great Britain. The acreage of horticultural crops or market gardens shown in the table consisted mainly of tomatoes grown in Gran Canaria; the value (17 million pesetas) was half that of the banana harvest.

The cultivation of potatoes depends on seeds shipped in autumn from Europe. The crop if planted on low-lying ground must be irrigated even in winter, but if grown at a slight elevation on soil largely mixed with broken tufa or pumice stone it will survive without artificial watering. The latter areas yield about 6.2 tons per hectare against 17.5 tons from irrigated fields. Potato diseases cause much trouble, especially as the potato and tomato, which are prone to the same attacks, are often planted either adjacently or alternately. In 1933 about 2,000 hectares of potatoes, yielding nearly 30,000 tons, were planted on Gran Canaria alone. The earliest shipments

of young potatoes to Europe usually begin about the end of January.

Among the more important of the lesser crops are cereals, citrus fruits, almonds, and the vine. In 1933 in Las Palmas province there were 900 hectares of almonds (400,000 trees producing 1,200 tons of fruit), 65 hectares of oranges (39,000 trees producing 2,200 tons of fruit), and 2 hectares of lemons (4,000 trees producing 240 tons of fruit). The oranges grown at Telde in Gran Canaria are among the finest in the world, being thin skinned and reaching 10 ounces in weight. The crop ripens in November, but at present is little exported owing to bad packing and grading. The vineyards lie mainly on the Monte Verde zone of Gran Canaria and include the slopes of the Caldera de Bandama. In 1933 the vine covered 1,900 hectares and yielded 1,460 tons of grapes for must (6,800 hectolitres) and 500 tons of grapes for the table.

In addition there are small acreages of olive, sugar-cane, tobacco, and numerous other crops, especially vegetables. The cochineal industry has now declined to a few tons a year, but it is interesting as typifying the meteoric rise and decline of many of the activities that have arisen in the Canaries. Beginning with 8 lb. in 1831, the shipments of cochineal rose rapidly, especially after the collapse of the wine trade about 1850. In 1869 the exports exceeded 6 million lb. (worth £790,000), but within a dozen years had dropped by two-thirds. However, the boom in cochineal had lasting effects on Canarian agriculture as it incited owners to undertake elaborate terracing and in parts even to break up old lava-streams in order to expose the ancient soil buried beneath them.

Live Stock and Dairy Produce. The best pastures in the Canaries are in or near the Monte Verde of Gran Canaria. In fattening stock for market, however, it is usual to turn them loose on land planted with lupine, beans, or other leguminous crops. Some of the cattle are bred for the supply of meat to ships and for export; others are milking-cows (often a cross between native stock and Jersey pedigrees) which provide cream for a little butter. Goats, swine, and sheep are also reared. The goats are usually put out to graze, but sheep and oxen also forage on the hills. The sheep are small, and the goats, although good milkers, are not much relished for the table. A special cheese (*flor de Canaria*) is made from goats' milk, the curdling being brought about by the flower of a wild artichoke (*cardo*).

The horses reared on the island are agile and sagacious, but being small they are not usually employed for heavy work, which is done

by mules and oxen. The numbers of livestock in Las Palmas province in 1934 are given in the following table:

Cattle	.	.	.	32,800
Sheep	.	.	.	16,500
Goats	.	.	.	75,700
Pigs	.	.	.	10,800
Horses	.	.	.	1,500
Donkeys	.	.	.	5,500
Mules	.	.	.	2,100

In addition there were nearly 250,000 hens, a few thousand ducks, and a considerable number of pigeons and rabbits.

Fishing. Las Palmas is capital of the eastern Canaries fishery region which includes Gran Canaria, Fuerteventura, Lanzarote, and the smaller isles of Graciosa, Alegranza, and Montaña Clara. During 1933 there were engaged in this area about 4,400 persons in fishing and another 50 in dependent occupations ashore. The total catch was 2,900 tons, the chief items by weight being tunny (1,000 tons), bonito, and small hake. By value the chief species recorded were tunny, small hake, and sardines. Fish-preserving was carried on at 10 salting- and 2 canning-establishments on Gran Canaria, all of which were situated in or near Las Palmas excepting one cannery (for tunny) at Guia. All told these factories employed 36 men and 29 women and handled over 1,800 tons of fish a year.

During 1933 the fishing-fleet working from Las Palmas consisted of 18 steam-driven vessels and 15 motor-vessels averaging 50 tons each and 60 sailing-ships of about the same size. Many of the sailing-ships probably also had auxiliary diesel engines.

Ports

La Luz, an annex of Las Palmas, is the only port in Gran Canaria. Elsewhere on the island there is nothing more than a few small moles intended solely for local coastal craft and often rendered unusable by swell or wind.

LAS PALMAS AND PUERTO DE LA LUZ. (Lat. $28^{\circ} 07' N.$, long. $15^{\circ} 24' W.$
Population 78,264, in 1930.)

General Description. The town of Las Palmas is situated at the north-eastern corner of the island. The port lies on the sandy southern shores of the headland of La Isleta and stretches across the narrow isthmus of Guanarteme which links it to the mainland; the heart of the town is about $2\frac{1}{2}$ miles farther south athwart the mouth of the



33. *Reservoirs in Gran Canaria*



34. *Irrigation channel and banana plantation, Gran Canaria*



35. *Puerto de la Luz*



36. *Puerto de la Luz*

barranco de Guinguada (Fig. 21). To-day the intervening stretch of coastal beach is covered with houses and the town and port form one settlement of nearly 100,000 people (Photos. 35-38).

The built-up area of La Luz is low and extends over the Istmo de Guanarteme to the shores of Confital bay. Las Palmas also lies almost entirely below 100 feet in altitude, but the country inland rises within a few miles to 750 feet. The town has a sea-frontage of about 3 miles, yet most of its buildings are within 800 yards of the sea. The part near the beach is palm-shaded, with wide streets and palatial houses typical of a modern English seaside resort; the streets at the foothills are steep, the dwellings small and not infrequently built among barren outcrops of rock. The houses are mainly built of pale grey tufa and occasionally of blue basalt, and all are brightly painted. This colouring and the numerous palms and shaded patios create a striking resemblance to an Andalusian town. The barrio, or municipal district, north of the barranco de Guinguada is called Triana, and that south of the barranco, Vegueta. The latter centres upon the cathedral of Santa Ana, which was founded in 1497 and partly restored three centuries later.

To-day Las Palmas is the capital of Gran Canaria, the headquarters of the civil governor of the eastern Canaries, and the seat of a bishop. Together with Puerto de la Luz it is at the same time the largest city and chief commercial centre of the Canary group.

History. Las Palmas was created a bishopric in 1485, two years after the final conquest of the island by the Spaniards. For some centuries it was dwarfed by S. Cruz de Tenerife, although its importance was sufficient to cause attacks by Drake in 1595 and by the Dutch in 1599. The town remained small and Puerto de la Luz was merely a refuge for fishing-boats until the coming of steam-vessels. The subsequent development was largely due to the initiative of foreign merchants and especially the British. The modern harbour of La Luz was commenced in 1883 and the S. Catalina mole had been constructed by 1902. Other alterations were made and the harbour was much enlarged after 1926, the new breakwater being completed in 1934. These harbour facilities, coupled with the rise of the banana trade and the popularity of the island as a winter resort, led to a marked growth in population and the small town of 14,000 inhabitants of 1864 grew to 45,000 people in 1905 and to nearly 100,000 people in 1941.

Industry and Commerce. Las Palmas has no power resources apart from imported fuels and has no notable manufacturing industries.

Among the few industrial concerns present are an ice-plant, one or two flour-mills and tobacco factories, and several fish-preserving establishments. There is also a small shipbuilding and a considerable ship-repairing industry.

In 1933 the total merchandise handled weighed 2,368,000 tons, of which rather more than half was exported. The ships calling, apart from the local coastal traffic, numbered 2,216 and totalled 7,500,000 tons. In the same year 23,000 passengers entered and 20,000 passengers left the port by ship. The chief exports were bananas, tomatoes, potatoes, almonds, and onions, and the main imports were petroleum, coal, wheat, sugar, and hardware.

Detailed Description. Puerto de la Luz is at the head of the bay lying between El Nido and the mouth of the barranco de Guinguada, 4 miles to the south. The approaches to this bay are deep and clear.

The artificial harbour is formed on the east by an outer breakwater which extends about 2,900 yards southwards from the south-eastern point of La Isleta, and on the north and west by the sandy coast now covered with the houses of La Luz. The harbour, however, is divided up by three moles: firstly, by an inner or older breakwater, 1,250 yards long, that lies 400 yards west of and runs parallel to the main breakwater; secondly, by the Muelle de Santa Catalina, which projects 550 yards eastwards from the mid-point of the west side of the harbour to within 300 yards of the inner breakwater so as to form an outer and inner harbour; thirdly, by the Muelle Comercial, which extends about 400 yards eastwards and then 300 yards northwards, thereby sheltering the small Puerto de Santa Catalina (Fig. 21).

In recent years the inshore end of the space between the two breakwaters has been reclaimed for a distance of 400 yards from the shore and the quays of the Esplanade have been constructed. In addition, the inner breakwater has been widened to about 30 yards for about 200 yards from the Esplanade itself.

The general depth of the outer harbour is 36 to 42 feet, except between the breakwaters where it is 42 to 60 feet. The inner harbour has depths of 3 to 42 feet, the seaward half being 18 to 42 feet deep. The neap tides rise about $8\frac{1}{2}$ feet and the spring tides $10\frac{1}{2}$ feet.

The quays of La Luz can accommodate 28 ships alongside, the outer breakwater being able to take ships of any size. In addition, there are numerous mooring-buoys for small craft in the inner harbour. The unloading facilities consist of a few small travelling cranes on the inner breakwater and on the Muelle de Santa Catalina,

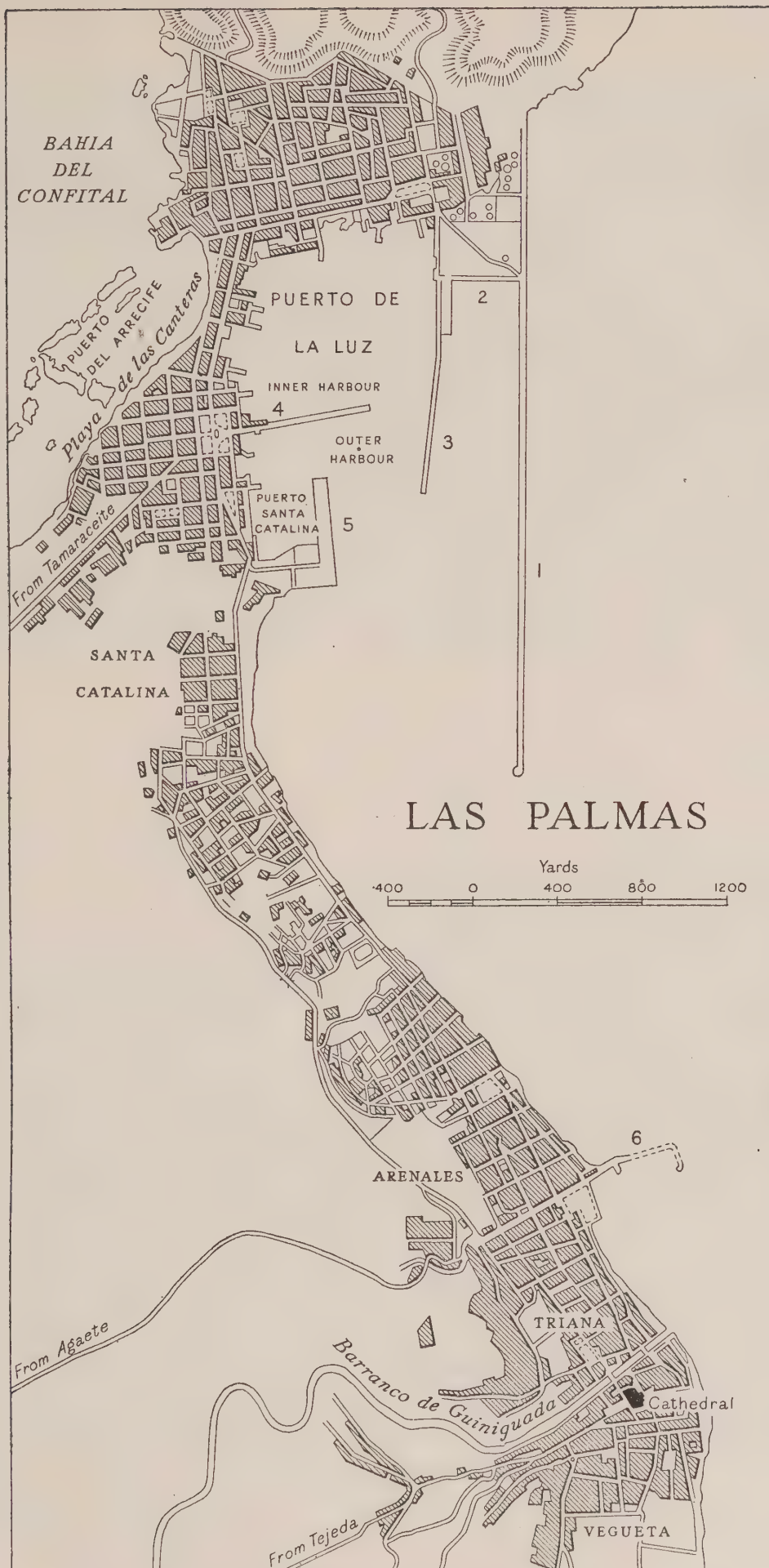


FIG. 21. Plan of Las Palmas and Puerto de la Luz

1. Outer (new breakwater). 2. Esplanade. 3. Inner (old) breakwater. 4. Muelle de S. Catalina. 5. Muelle Comercial. 6. Muelle de Las Palmas (in course of extension)

otherwise discharge is by ships' appliances to the quay or to lorries. The harbour craft available include a few large tugs and a considerable fleet of small lighters, motor-launches, and water-boats. The facilities for coaling are good and for oil-fuelling excellent, pipelines being laid on to numerous points on the inner and outer breakwaters.

Details of the length and width of the various quays and breakwaters and of the depth of water alongside are given in the following table:

	<i>Length available for shipping (feet)</i>	<i>Approximate width (feet)</i>	<i>Depth alongside (feet)</i>	<i>Berths</i>
Outer breakwater .	6,600	50	36-56	12
Inner breakwater .	3,500	40	33-46	7
Esplanade . . .	960 east-west 750 north-south	Unlimited E.-W. 160 N.-S.	36-46	..
Muelle de S. Catalina .	1,400 on each side	90	10-28	4
Muelle Comercial .	1,600	200 to 600	29	3

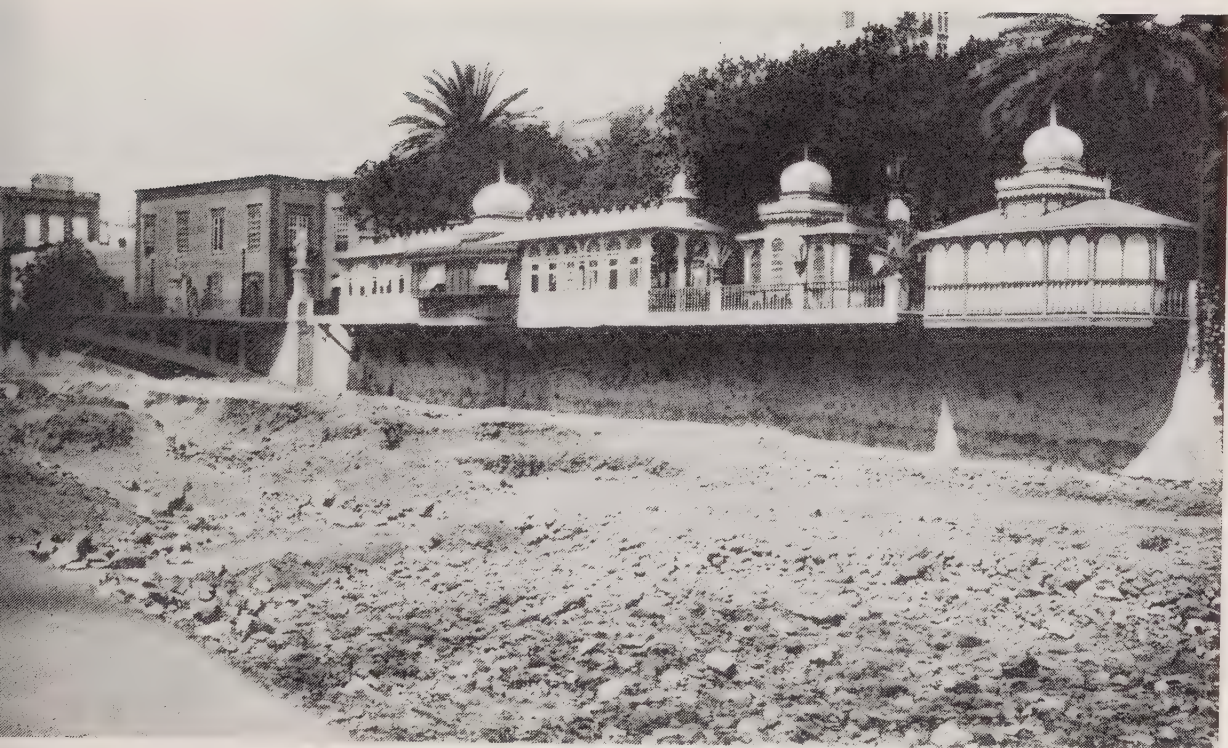
The Esplanade, built as a fruit quay, was unpaved and had no sheds in 1942. The Muelle de S. Catalina will take ships of up to 7,000 tons on both of its sides and has facilities for water and for the landing of cargo and passengers. The Muelle Comercial can probably take vessels of up to 3,000 tons.

Port Facilities. There are no docks at Puerto de la Luz, but ship-building and ship-repairing is a relatively important industry. Blandy's have two patent slips with a lifting power of 1,500 tons and 1,000 tons respectively, and each capable of taking ships up to 250 feet in length. This firm also carries out extensive repairs. In addition Hull Blythe & Co. have a small slipway for port craft and a fair-sized repair workshop.

Communications. Two main roads lead from the port of La Luz, one southwards along the coast to Las Palmas, and the other south-westwards to Tamaraceite via Confital bay. From Las Palmas main roads run southwards to Telde and all the southern parts of Gran Canaria, westwards to Tamaraceite and the northern coastlands, and south-westwards to S. Mateo and the highland regions of the island. In addition to the main coastal road between La Luz and Las Palmas there is an auxiliary road running parallel with the shore but about 600 yards inland. Passenger transport between the quays of La Luz and the centre of Las Palmas is maintained by a frequent service of motor-buses.



37. *Puerto de la Luz*



38. *Dry river bed in Las Palmas*



39. *Main road near Tejeda*



40. *Tunnel on Las Palmas-Telde road*

The external connexions of Las Palmas depend mainly on the callings of vessels plying between Europe and S. America and S. Africa (p. 100), and on radio communications (p. 348). Gran Canaria will also probably become a focal point on airways between Europe and S. America. By sea it is 1,428 nautical miles to Plymouth, 700 miles to Gibraltar, 262 miles to Madeira, and 53 miles to S. Cruz de Tenerife.

Communications

The internal communications in Gran Canaria are almost entirely by road or local steamer, as there are no railways or inland waterways.

The island has over 120 miles of first-class road and the mileage is rapidly increasing. The roads are usually good, with a metalled surface, and are between 18 and 27 feet wide. Owing to the mountainous character of the island the roads are often winding and cross many ravines varying in depth from 50 to 700 feet. The bends, however, are designed for motor traffic and the bridges are strong, being built of stone. The usual traffic on the roads includes many tourist cars, single-decker buses, and 5-ton fruit lorries. Where the motor-roads end, mules are the main pack-animals, and they can be safely trusted along the sometimes almost invisible tracks which lie along precipitous slopes.

Road Network. There are three main roads in the island, radiating from Las Palmas, the rest being short branches leading from them (Fig. 22). The North Coast road runs through the many villages between Las Palmas and Agaete, and is reported motorable as far as Aldea de S. Nicolas, though the latter section has only recently been completed. The Central road joins Las Palmas with the interior of the island, and runs through the Monte to Tejeda. The South road follows the line of the east coast to Agüimes, and thence winds inland to S. Bartolomé and Fataga; an important branch of this road runs south to Arguineguin. The network of motorable roads therefore shows a high concentration of good roads in the Las Palmas-Puerto de la Luz area, an adequate service in the more populated districts of the north and centre, and an almost complete blank along the west coastal region. It is planned, however, to close this gap with a road from Arguineguin through Mogán to Agaete, and work on this section was reported to have begun in August 1941. Rough-surfaced roads have also recently been built between Arguineguin and Mogán, and from Tejeda through Artenara to Agaete. The

villages not at present joined to the capital by motor-road rely on mule transport or on the local steamers.

Main North Road. This, road number 3 in the local system, is of corniche construction and winds across many ravines, running in places along the cliff-tops and in places 3 miles inland. There is one tunnel, about 270 feet long, 6 miles from Las Palmas at the entrance to the village of Tenoya.

On leaving Las Palmas the road crosses the arid hills rising to about 650 feet which separate the city from Tamaraceite, whence fields of bananas and sugar-cane stretch on either side of the road to Arucas (11 miles). Turning north as it leaves the town, the road passes on the west a large reservoir, and continues along the cliffs, backed by intensively cultivated country, to Guia (22 miles) and Gáldar (25 miles). An arid area of low hills, through which the road runs well inland in a south-west direction, separates Galdár from Agaete (30 miles). The extension to Aldea de S. Nicolas (47 miles) passes through sparsely peopled mountains which fall precipitously to the sea; there is no information as to the direction taken by this road beyond El Risco.

The most important branches from the North road run from Arucas to Teror ($6\frac{1}{2}$ miles) and to Firgas and Moya ($18\frac{1}{2}$ miles from Las Palmas).

Main Central Road. This, the best road in the island, is number 1 in the local road category. It follows the barranco de Guinguada from Las Palmas to S. Mateo, and thence crosses the mountains to Tejeda. Much of it therefore is of corniche construction, with sharp turns, and has gradients up to 1 in 8 beyond S. Mateo (Photo. 39).

The road leaves Las Palmas by a bridge over the barranco, passing the large covered reservoir of the Las Palmas waterworks, before climbing up the Pico de Viento to 820 feet. The two small hamlets of Tafira Baja and Tafira Alta (5 miles) lie to the east of the road, which then continues to climb through the green pleasant countryside of the Monte to S. Brigida ($8\frac{1}{2}$ miles). The road rises through an increasingly wooded and mountainous region to S. Mateo (13 miles), which lies at 2,670 feet. Between S. Mateo and Las Lagunetas the trees thin out and the road makes a winding climb over barren hill-slopes to 4,100 feet, commanding views of the whole island. After a descent to the village of Las Lagunetas ($18\frac{1}{2}$ miles) there is a climb with many sharp curves on the route to Cruz de Tejeda (22 miles), which lies at 5,740 feet. Thence the road descends to the village of Tejeda (28 miles), its present terminus.

The most important branches from the central route run from the Monte and S. Mateo to Telde, and connect with the North Coast road through Cruz de Tejeda and Teror.

Main South Road. The road to the south (2 in the local road category) has a good macadam surface and is fairly level to Agüimes, whence it winds steeply uphill to S. Bartolomé, though the gradients do not exceed 1 in 8. Four miles south of Las Palmas at Palo point the road passes through a narrow tunnel about 15 feet high (Photo. 40).

From Las Palmas the road runs along the coast with banana plantations extending on its western side, which give place to low cliffs near La Laja, just before reaching Punta del Palo (4 miles). The road then leaves the shore and approaches the valley of Telde (8 miles) across the dreary lava-flow country around Jinamar. Having traversed the streets of Telde, the road enters an uninteresting arid plain and passes the villages of Lomo Gordo (11 miles) and Agua Tona (13 miles) on the way to Agüimes (18 miles). From Agüimes the route turns westward and, after skirting the edge of the plain, winds up the northern slopes of the precipitous ravine of the Tirajana valley to S. Lucia (32 miles), which is surrounded by orchards and cultivated land. Through fertile hilly country a winding climb leads to S. Bartolomé de Tirajana at roughly 3,000 feet (36 miles). The last section of the road turns due south down the ravine of the Fataga barranco, and descends about 1,000 feet before reaching Fataga village (40½ miles). It is reported to be now nearly completed to Maspalomas (51 miles), which stands about 2 miles from the sea in the lower valley of the Fataga.

The branch road, which leaves the main road 12 miles south of Las Palmas, is an important connexion to Arguineguin. From its junction with the main road 1 mile south of Lomo Gordo it runs south-east towards the airport at Gando, but at 15 miles turns abruptly to the south-east and passes Carrizal (19 miles). The countryside is arid, flat, and sparsely peopled on the way to Juan Grande (27 miles) and becomes gradually more sandy towards Maspalomas (34 miles). The road thence skirts to the north of the marsh and sand-dunes near the Fataga barranco and runs directly into Arguineguin (41 miles).

TENERIFE

PHYSICAL GEOGRAPHY

Relief

Tenerife (Teneriffe) is a rough triangle about 919 square miles in area, with a greatest length of $52\frac{1}{4}$ miles and a maximum width of $31\frac{1}{4}$ miles. A mountain ridge, which traverses the centre of the whole of the island, begins in the north-east as the Anaga mountains and occupies the whole peninsula from Punta de Anaga to the neighbourhood of Santa Cruz. The range consists of razor-backed hills, peculiarly jagged in outline and attaining a height of over 3,000 feet. Both sides of the ridge are gullied by deep valleys, which, however, are usually V-shaped in cross-section as distinct from the U-shaped nature of the typical barranco. In most parts the mountain spurs reach the sea, there being no coastal lowlands except the sandy patches at the mouths of a few of the valleys (Fig. 23).

Near La Laguna the peninsula widens and the Anaga ridge sinks to a plateau or broad depression lying at an altitude of about 2,000 feet. This flat upland drops almost gently to the sea leaving a small plain on each coast; Santa Cruz de Tenerife stands on the eastern edge of this area.

About 3 miles from La Laguna the land rises again to the Cumbre, a volcanic ridge, deeply dissected by barrancos, which increases in height and steepness towards the south-west. Opposite Villa Orotava this mountainous backbone already exceeds 6,000 feet. Here, at the junction of the whole north-eastern peninsula with the main body of the island, the ridge has been greatly narrowed by the formation of two opposing lowlands. On the north is the depression between Villa Orotava and Puerto de la Cruz, and on the east a somewhat similar lowland near Güimar. These depressions are by no means true plains, but they are very distinct because of the high cliffs that bound them on the landward side. The Orotava lowland is broken by craters or cinder heaps, such as Montaña de las Arenas and Montaña de Chaves near Puerto de la Cruz, and it is inclined towards the sea. On the west the wall of the depression rises abruptly towards the Cañadas, and on the east and south to the central ridge of the island. In its lower parts the valley-floor has a slope of 1 in 18 to 1 in 9; at about 1,600 feet the slope increases to 1 in 5 and over, but at 3,000 feet again falls to about 1 in 9. The steep mountain slopes of the Cumbre commence at about 5,500 feet, but these are less precipitous than



FIG. 23. Relief of Tenerife

the walls (*laderas*) to the west and east of the valley, where the gradient in parts is 1 in 2 or even more. The Güimar depression is very similar; it is broken by the volcano near Arafo whence two black streams of lava wind down the mountain-side almost to the sea, and by the Montaña Grande (960 ft.), the latter being a cup-shaped fumarole, about 200 feet deep and over 1,000 yards in circumference. On the south the depression is dominated by the almost sheer walls of the Ladera de Güimar. The narrowest part of the mountain backbone separating the depressions of Orotava and Güimar is at Pedro Gil, where a col at just over 6,000 feet provides a route for the track between the two basins.

A few miles south-west of Pedro Gil the main ridge forks to form the enclosing walls of a vast but imperfect crater that occupies the heart of the main body of the island. On the south and east the crater rim is strongly developed and rises for the most part to between 7,500 feet and 8,500 feet. It looks northwards to the crater floor, which is an undulating plain about 6,500 to 7,500 feet above sea-level. This desolate region, known as Las Cañadas, is floored by volcanic debris varying from a desert of lava with a fringe of pumice near Guajara to a desert of pumice interspersed with lava near El Portillo. The northern and western parts of the crater have been obliterated by newer volcanic outbursts that have built up the vast cone which culminates in the Pico de Teide (12,162 ft.), the great landmark of the Canaries (Photo. 41). The upper slopes of the cone are steep (average 1 in $2\frac{1}{2}$) and are usually snow-capped from October to May. The wellings of lava that formed Teide swept down to the sea near Icod and Garachico, where the lava still retains its ripples and waves of flow; in the same way the western part of the main crater has been hidden or destroyed by newer outpourings that descended to the sea near Chio. Hence on the north and the west the Pico de Teide falls with an unbroken slope to the coast (Photo. 42). The relatively recent nature of these outflows is of significance, since it has not allowed an excessive development of barrancos such as occurs on all the southern and eastern parts of Tenerife, much to the detriment of communications locally. On the other hand, there is practically no coastal plain in the north, whereas in the south and east the 500-foot contour is usually $1\frac{1}{2}$ to 3 miles from the coast. This lowland fringe is, however, occasionally broken by small craters and cinder-heaps and it does not compare in size or flatness with the coastal plain on the south-eastern side of Gran Canaria.

In the north-west of Tenerife the main volcanic mass sinks through

a series of minor cones to the peninsula of Teno. This area consists mainly of old lava-flows which have been eroded into a relief similar to that of the Anaga peninsula. The main ridge rises to 4,377 feet in Montaña de Gata; it is deeply dissected by valleys on both flanks, those on the north being V-shaped, while those on the south, although short, are deep and abrupt-sided. The north coast of this peninsula is bordered by small plains near Buenavista and by a small coastal platform near Teno Bajo; elsewhere, especially on the south, mountain spurs drop precipitously to the sea.

Drainage and Water-supply

There are about 130 main barrancos in Tenerife; of these 80 enter the coast between Santa Cruz and Santiago, while most of the remainder occur on the northern slopes of the island between Las Palmas and Icod de los Vinos. Nearly all of the barrancos are dry throughout their length except after periods of rain, the only valleys which contain water for the greater part of the year being those draining to the north coast from the Llano de los Viejos. Short stretches of a few valleys originating near the main watershed would contain permanent streams were not their sources of supply tapped and led away in artificial channels.

Very little water is allowed to run to waste, almost every usable spring being caught up and led to the towns and cultivable areas by means of pipes and by open stone- or cement-lined channels, many of which run along the wall-tops. As a general rule, water is plentiful on the northern coasts of Tenerife and on the upper flanks of the main mountain background throughout the island; it is scarce on the mountain slopes and coastal plains of the south-east, south, and south-west (Fig. 24). It should be taken for granted, however, that even the best-watered areas could profitably use more water if it were available. Throughout Tenerife the springs are likely to be most copious and water most plentiful from December to March, after which the prolonged drought and high evaporation rapidly dissipate all but the strongest sources of supply. In the Anaga peninsula springs break out on the upper northern slopes of the Llano de los Viejos and give rise to a few short streams with a more or less permanent flow. Since the cultivable areas are extremely restricted, earthen storage tanks are uncommon here and occur only near Punta Hidalgo and San Andrés.

The plateau of La Laguna has a reliable supply of ground-water at reachable levels on the tableland itself and taps strong springs on

the adjacent mountain slopes. The main problem is the supply of the Santa Cruz district. The city obtains drinking-water from covered reservoirs near the barranco de los Santos; water for irrigation comes from the presa de Tahodio which lies about $2\frac{1}{2}$ miles to the north at 800 feet in the valle de la Vega. This reservoir, of 236 million gallons capacity, is half a mile long and is held back by a massive

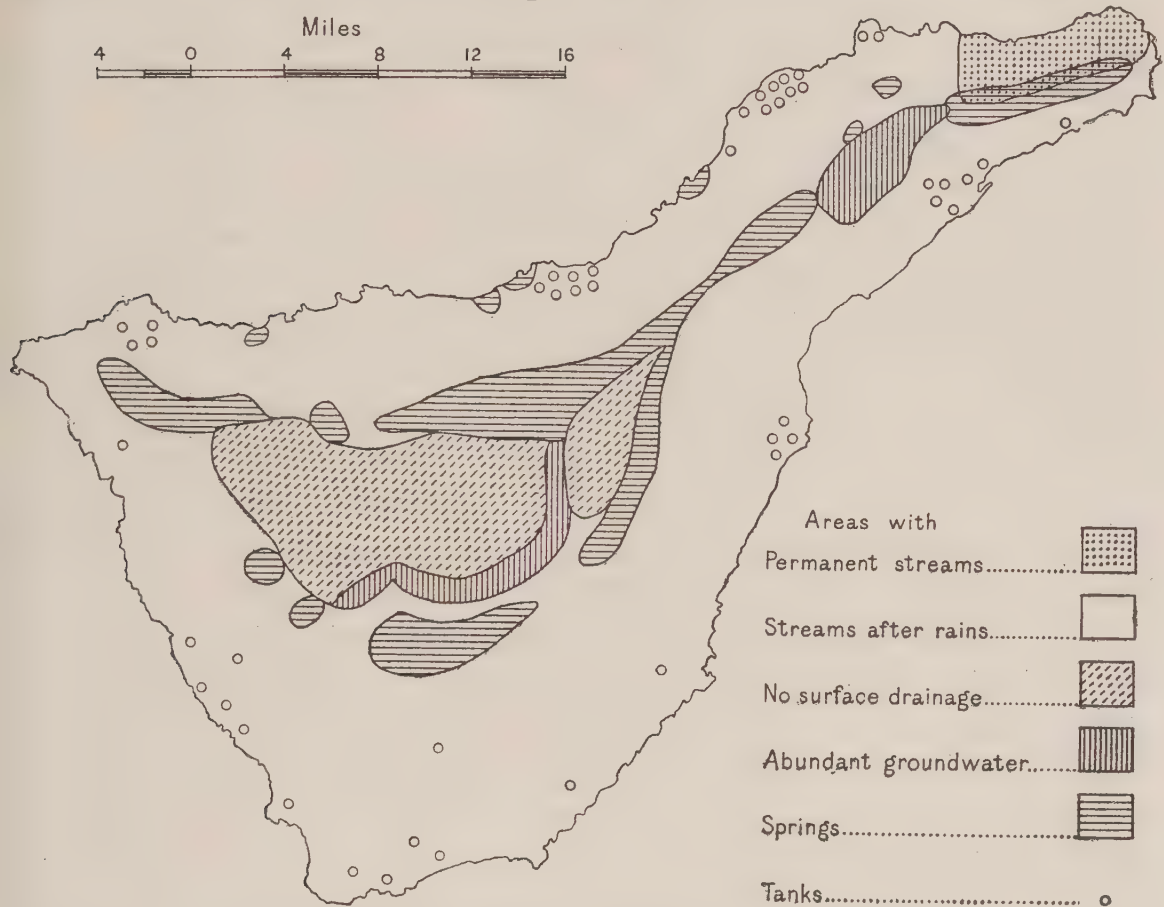


FIG. 24. *Water-supply of Tenerife*

dam 144 feet high. Supplementary water for irrigation is obtained from *galerías* near Arafo, a main aqueduct leaving the galería de las Madres at 1,800 feet and sending a branch to the neighbourhood of both Santa Cruz and La Laguna. The storage of water in earthen tanks is common near Santa Cruz and even more frequent in the north-west between Tejina and Tacoronte. In the latter area spring-water from Garcia, 2,600 feet above the coastal strip, is stored in circular concrete reservoirs as well as in earthen tanks. The village of Tacoronte also obtains a scanty supply of drinking-water from three fountains. Springs of water occur in a few of the deep coves on the sea-coast west of Tacoronte and Tejina and are put to full use, mainly for agricultural purposes.

In the high mass of the Cumbre springs break out mainly on the western flanks of the crest, the main available supplies and chief storage tanks being near La Victoria de Acentejo.

The basins of Villa Orotava and Güimar have a much denser population and a correspondingly greater need of water than the Cumbre region. These two depressions obtain their main supplies from springs and galerías in the adjacent mountain ridge. The Arafo area is supplied mainly from borings driven in the sides of the barrancos furrowing the slopes above the town. Most of the water comes from the galería de las Madres in the barranco Anavingo, from the galería de los Huecos (3,937 ft.; 95,000 gallons per hour), and from the galería Agrícola de Arafo (70,000 gallons per hour). The copious nature of these underground sources does not mean that tunnelling is automatically successful, and one galería was sunk for about 500 yards in the barranco Cambuesa without finding water. The Güimar area obtains most of its supply from galerías in the barranco del Río and from the Madre del Agua spring. The latter, which lies at 2,500 feet west of the town, also supplies the local power station. There are many storage tanks for irrigation purposes in the terraced farmlands east of Güimar.

The Villa Orotava basin is adequately watered. The town itself has a drinking-supply led in iron pipes from springs at La Paz, while some houses have a private supply from springs at La Perdoma. Water for irrigation comes from local springs and from galerías high up on the eastern and north-eastern flanks of the basin. Supplies are stored in earthen tanks and circular concrete reservoirs, both of which abound between Humboldt Corner and Villa Orotava, an especially large tank being situated midway between the two places. Another source is the waterworks on the cliffs (50 ft.) at Gordejuela, which is capable of raising 1,600,000 gallons a day to an altitude of 950 feet for the irrigation channels in the lower parts of the Orotava basin.

The small cultivable areas of the northern coast between La Guancha and Buenavista are fed by an almost continuous water-channel. Full use is made of a few good springs near the crest of the main ridge to the south, but the only notable sources actually in the coastal strip are the springs near Garachico. Storage tanks for irrigation water are uncommon, except on the plain of Buenavista.

The central volcanic mass of Tenerife has no surface flow. Las Cañadas is arid except where ground-water, accumulating at the base of the steep outer rim, gives rise to a few perpetual springs, the chief

being one yielding excellent drinking-water at Fuente de la Grieta about 5 miles south of El Portillo and another close to the pass of Guajara.

The eastern, southern, and south-western slopes of the island, from El Escobonal to Punta de Teno, are mainly arid since the spring-line near the mountain ridge is usually weak and often peters out altogether. A few localities, however, manage to obtain sufficient for their needs. The El Escobonal district has tapped underground aquifers by tunnelling in the barranco de las Coteras; just to the south in the barranco de Herques water can generally be found by digging in the sands of the valley-floor. The area between Icor and El Río makes use of a few galerías and a few springs near the heads of barrancos, but the supply is not copious and storage tanks are rare. Near the beach at Puerto de El Médano there is a spring of palatable water. To the west the country is arid as far as Adeje and Hoya Grande, where much water is obtained from a few springs and galerías on the mountain slopes. The deep chasm of the barranco del Infierno north of Adeje has a permanent spring that forms a high waterfall and feeds the water-channels leading to the coastal area and to a large tank near La Atalaya. The galerías above Hoya Grande—some water coming from high up on the outer rim of Las Cañadas—provide good drinking-water and also feed two fairly large tanks. In the neighbourhood of Guia de Isora there are a few water-channels, but on the adjacent coastal strip, especially near Alcala, the supply deteriorates and the numerous wells hereabouts are brackish.

Vegetation

The composition and zonal arrangement of the vegetation of Tenerife has already been described in detail in Chapter IV; the general distribution of the plant-life is shown in Fig. 11.

Coasts

The coasts of Tenerife form a triangle which has its base lying between Punta de Teno and Punta de la Rasca, and its apex in the north-eastern peninsula of Anaga. The coasts are steep-to, and vessels can anchor close inshore except off Anaga point and in the neighbourhood of Garachico. Much of the coast, particularly in the west, is formed by high cliffs, though sandy beaches are fairly extensive on the east coast.

The eastern coast is divided by projecting headlands into three sections: the northern stretching south-west between Punta de Anaga and the headland formed by the slopes of the Volcan de Güimar;

the central to Punta de Abona; and the southern curving to the south-western promontory of Punta de la Rasca. The first section of this coast is fairly regular in outline, the seaward edge of the Anaga peninsula being bordered by high cliffs, which shut off an almost impassable country, deeply dissected by ravines. There is a small beach of fine black sand at the foot of the cliffs below the fishing-village of S. Andrés, which is situated along the valleys of two streams, in the shelter of the Anaga mountains. A quay was reported to be under construction here in 1942 (Photo. 43). S. Andrés is the terminus of a good motorable road which follows the coast thence to Santa Cruz (4 miles). A second beach is formed at the mouth of the intensively cultivated barranco del Bufadero, and half a mile to the south of this a small cove occupied by coal wharves is used as the outlet for the Jurada quarries.

Between the fort of Paso Alto, on the northern side of the Valle de la Vega, and Puerto Caballo lies the harbour of Santa Cruz formed by a basin enclosed between two moles, which is secure except in easterly gales. The town expands on gently sloping land below 300 feet, most of the houses being alined parallel to the waterfront. The peaks of the Anaga and Cumbre mountains appear from the sea to surround the town, but a hilly depression between them gives access to La Laguna and the north coast.

From Santa Cruz to Güimar the cliffs are bold, steep, and clear of off-lying dangers, and are backed by a cultivated coastal fringe. The main Santa Cruz-Güimar road follows the coast between one-quarter and 2 miles inland. There is one fishing-village at Candelaria, where the boats are pulled up on the wide, black sandy beach. The Volcan de Güimar, rising abruptly from the sea to 925 feet, cuts off the town of Güimar from the shore. A small outport with a mole lies to the south of the headland and is connected to the town by a motorable road 3 miles long.

The 12-miles of coast between Punta de Güimar and Punta de Abona has low cliffs fringed by narrow beaches and dissected by numerous barrancos. The coastal zone is mainly flat, with some low hills here and there, behind which rise the pine-clad ridges of the central mountains. There is only one sheltered anchorage, in the bay enclosed by the headlands of Ternero and Abona. There is a beach in the centre near a hamlet which is joined by a $3\frac{1}{2}$ -mile metalled road to Arico Viejo.

The south-eastern and south coasts between Punta de Abona and Punta de la Rasca are roughly 23 miles long. Much of the shoreline



41. *Pico de Teide*



42. *Pico de Teide from Icod*



43. *S. Andrés, Tenerife*



44. *Coast of Tenerife near Puerto de la Cruz*

is very flat, and basaltic reefs alternate with small bays of black volcanic sand. Semi-desert country, in places covered by desolate lava-flows, extends behind the coast, the land rising fairly gently up to 600 feet. A small sandy beach occupies Médana bay, just north of the promontory of Punta Roja which rises conspicuously at the south-east corner of the island to 580 feet. A hamlet lies scattered along the shores of this bay, and a motorable road leads inland to Granadilla. West of Punta Roja there are two anchorages, one in the Playa de Confital in depths of from $3\frac{1}{2}$ to 9 fathoms and the other with a depth of 9 fathoms, in the bay of Galletas, where a beach of black shingle is used by fruit steamers and local boats.

The western coast of Tenerife (29 miles long from Punta de la Rasca to Punta de Teno) is very steeply and irregularly cliffed, with fewer beaches than on the east coast. The cliffs are mainly basaltic material, sometimes in columnar form, and are particularly inaccessible in the north, where Teno point and the neighbouring coastline form the seaward edge of a lava stream. It is not easy to land on this coast, the small ports being used only by local vessels. In the south the Puerto de los Cristianos overlooked by the Montaña de Guaza (1,400 ft.) has a beach-fringed bay, with a small mole lying between barren cliffs. Puerto de San Juan, a similar small bay, provides anchorage for small vessels in depths of 4–9 fathoms and is the terminus of the main north coast road, the distance to Icod being 19 miles. The other anchorages which lie at Puerto de Santiago and off the headlands of Tamaimo and Masca are at the openings to deep valleys connected inland by the roughest of mule-tracks.

There are two sectors of the north coast, the western to Punta de Barranco Hondo being dominated by the Pico de Teide, the eastern forming the shore of the Cumbre and the Anaga peninsula. The north-western coastline is rocky and deeply dissected, and owing to heavy seas the ports, other than Puerto de la Cruz, are used only by local fishing-boats. The coastal region is very fertile and many villages lie above the cliffs, and the main North Coast road parallels the shore from Buenavista eastwards. Garachico is the western of the ports and has a mole built on a reef projecting from the town and exposed rocky anchorages in 12 fathoms by the islet of El Roque. This, once the most utilized port in Tenerife, was devastated by lava-flows in 1705 which partially filled the harbour, and made the approach very difficult. The islet of El Roque and the surrounding rocks are legacies of this eruption. A mole has also been constructed at Puerto de San Marcos, a fishing-village 3 miles east of Garachico.

The harbour of Puerto de la Cruz, the best port on the north coast, though the anchorage is very exposed to prevailing winds, lies between the points of Montaneto and Barranco Hondo. There is a small basin formed by two breakwaters on the east, beyond which stretches the sandy beach of Martianez. The town is a cluster of white houses at the head of the bay and is connected by a steep road to Villa Orotava. This town lies in country noted for its fertility, and its products are exported from Puerto de la Cruz (Photo. 44).

The northern shore of the Anaga peninsula is steeply cliffed, and the country rises abruptly to between 1,640 and 2,300 feet. There are three anchorages: first in the beach-fringed bay of Tegueste which has 18 fathoms of water, the nearest village being Sauzal; secondly, the bight of La Tejina with depths of 8 fathoms, the hamlet of Milán lying just inshore; and thirdly in La Hoya bay, where landing is possible but difficult near the village of La Hoya. Beyond Punta Hidalgo the road along the coast ends, and the high cliffs which stretch thence to Punta de Anaga are paralleled by rough mule-tracks. A group of rocks, the southern of which are joined by a reef to the coast, extend about 1 mile north of Punta de Anaga.

HUMAN GEOGRAPHY

Distribution of Population

In 1930 Tenerife, with 224,329 inhabitants, had a larger population than any other island of the Canaries. The density of population was 244 persons to the square mile. S. Cruz, the capital, is the only large town and has about one-quarter of the total population. The rest of the population is mainly rural, only three districts (La Laguna, Orotava, and Icod) having over 10,000 inhabitants and five others over 5,000 people (Fig. 26).

The dominant factor in the distribution of population is the height and extent of the Pico de Teide and the neighbouring volcanic mountains which limit settlement to a narrow coastal fringe, not more than 4 miles wide in the north and east. As in Gran Canaria, the north coast is a region of extreme fertility and dense population, contrasting markedly with the arid sparsely peopled hills of the south and west.

The houses of the Tenerife peasants are perhaps a little more elaborate than those of Gran Canaria, especially in the richer districts, where they often have luxuriant gardens. There are also fewer troglodyte villages than in Gran Canaria as the lavas are less suitable

for the excavation of cave-dwellings. Some of the older streets in S. Cruz, Orotava, and La Laguna still retain old seignorial houses which resemble their counterparts in southern Spain in their patios, galleries, and elaborately carved wooden balconies.

Anaga Peninsula. The sparse population on the peaks and deeply scored ravines of the north-eastern peninsula distinguishes it as a population region from the densely peopled corridor between S. Cruz and Tacoronte; the villages of Tegueste and Tejina which stand at the junction of the two regions are used as summer resorts by the residents of S. Cruz. The general level of the peninsula varies between 1,600 and 2,500 feet, the upper slopes being covered with the remnants of the Mercedes forest. The valleys descend precipitously to the sea, particularly on the north coast and near the Anaga lighthouse, but on the south there are small flats at the mouths of the barrancos on which the fishing-villages of Igueste and S. Andrés have grown up. S. Andrés, with about 600 inhabitants, is now connected by a main road to S. Cruz. Three miles nearer S. Cruz there is a village in the fertile Bufadero valley which produces almonds and tomatoes. Inland, about nine small hamlets are scattered in the hills; the largest of them is Taganana, its red-roofed houses clustered in a valley below precipitous slopes.

S. Cruz-Tacoronte Corridor. This hilly depression extends between the Anaga and the Cumbre mountains and is about 6 miles wide and $10\frac{1}{2}$ miles long. It forms an important link between S. Cruz and the densely peopled north-coast area. It will be remembered that the Spaniards, after forcing a landing in the Valle del Bufadero and eventually occupying the wedge of country thence to the site of La Laguna, made the final conquest of the island certain, despite the tenacity of the Guanches. In 1930 the region had about 95,000 inhabitants, 80,000 of whom lived in the towns of S. Cruz and La Laguna.

S. Cruz lies mainly below the 300-foot contour; behind the city can be seen the Pico de Teide and its foothills. There are no large suburban villages near by, and the cultivated hill-slopes extend immediately outside the town, rising gradually towards La Laguna. The town became the capital in the nineteenth century, when it had far out-stripped La Laguna in size and importance; originally, owing to the constant incursions of enemy raiders, an inland position was much safer for the capital. The town and harbour of S. Cruz are fully described on pp. 160-163.

La Laguna lies 7 miles inland at a height of 1,774 feet and has a climate which is considerably cooler than S. Cruz in summer. It

has therefore become a convenient summer resort for the Governor-General and many of the inhabitants of S. Cruz. The town commands an intensively cultivated, well-watered plain, which gives an impression of great fertility with its small fields, bordered by hedges of prickly pear, producing wheat, maize, beans, lupine, and many fruits. La Laguna itself, which is the second largest town in Tenerife with about 20,000 inhabitants, has a cathedral as well as several churches and former convents, the oldest of which is the Iglesia de la Concepción, started in 1511. The town, the seat of the Bishop of of Tenerife and the Western Canaries, has a university (Photo. 45).

To the west of La Laguna the population thins slightly where the land rises to over 2,000 feet, and then rapidly increases 6 miles distant from the north coast. The houses are scattered over a verdant countryside, and are made conspicuous by the small groups of trees which are often planted around them. A low range of hills separates the villages along and near the main La Laguna-Orotava road from those on the northern slopes such as Rosario, El Socorro, and Tegueste. Tacoronte and Sauzal stand at the junction of this region with the north coast. Tacoronte, with about 4,000 inhabitants, has a group of new houses near the terminus of the electric tramway from S. Cruz, whilst the older part of the town stands around the churches on the flanks of a low hill. Sauzal is a large village above the cliffs, its houses scattered over a considerable area.

Northern Coastal Area. An almost unbroken line of settlement extends along a narrow seaboard, rarely more than $2\frac{1}{2}$ miles wide, between Tacoronte and Buenavista. In no part of this area can the influence of the Pico de Teide be ignored, the villages being confined to the seaward edge of this volcano. Even in this small area the fertility of the volcanic soil is such that it supports over 75,000 inhabitants; this population is almost entirely agricultural, the only other considerable source of income coming from tourists and invalids. The districts of Villa Orotava and Puerto de la Cruz contain together rather less than one-third of the total population, Icod being the only other district with over 10,000 inhabitants. The other districts have an average population of between 3,000 and 4,000.

A narrow spur of mountainous country separates Tacoronte from Matanza de Acentejo, which is the first of the north-coast villages reached from S. Cruz. Here the land is extremely stony, the fields being divided from each other by low walls, and the surplus rocks piled into pyramids in the fields. At Matanza the luxuriant



45. *La Laguna*



46. *Garachico*



47. *Puerto de la Cruz*



48. *The Orotava valley*

vegetation, so characteristic of the whole region, recommences. White- and colour-washed cottages, standing in the shade of tall palm-trees, line the main road from Matanza and La Victoria de Acentejo across the ravine of the barranco Hondo to S. Ursula. These three villages, which together have a population of about 9,000 inhabitants, lie about half a mile inland, at between 8,000 and 10,000 feet.

S. Ursula stands at the threshold of the Valle de Orotava, which lies in the shadow of the Pico de Teide curving gently towards the sea. The pleasing variation in the land-forms and the richness of the vegetation have become well known since Humboldt first eulogized them, and were probably the origin of the legends about the garden of the Hesperides. The beauty of the valley has been threatened in recent years by the increasing acreage under bananas, their ragged dull-green foliage taking the place of a greater variety of cultivated plants. The town of Orotava is the centre of the valley and commands the third most populous district in Tenerife, with 14,500 inhabitants (Photo. 48). Orotava, like La Laguna, has little commercial activity and has grown very little in modern times, still retaining many of its old houses. There are several large hotels which are visited mainly by foreign tourists and invalids. The town is closely connected with its port of Puerto de la Cruz (p. 163).

The population is very dense between Orotava and Icod, the 82,000 inhabitants being concentrated almost entirely below the 2,000-foot contour. The villages either spread along the main road, close to the cliffs, or lie above 1,000 feet in the valley of a small barranco. The houses, however, are very dispersed, and practically no cultivable land is unoccupied. The two Realejo villages are separated by the deep ravine of the barranco del Patronato which feeds these villages and the hamlet of S. Vicente. Continuous fields of tomatoes and bananas extend as far as the small town of S. Juan de la Rambla which straggles along the main road near the shore. Its district has about 3,000 inhabitants and includes the houses scattered on a spur of high land above the town. West of S. Juan an arid desert of stone marks the course of a lava-flow from the Pico de Teide; on the small fields worked wherever the soil is sufficiently decomposed for cultivation, maize, bananas, and citrus-fruits are grown. The largest settlement is La Guancha, which stands 2 miles inland, its fields irrigated from the water of a barranco. Icod itself commands the fourth largest district in the island with 12,120 inhabitants. The white houses of the town, surrounded by tall palm-trees, lie on an intensively cultivated slope at about 700 feet. There are

also many houses lying on the upper slopes above the town up to 2,800 feet. The Pico de Teide is here clearly visible and dominates the whole district. Icod is a market centre dealing mainly with the fruit trade, but small quantities of silk are manufactured. The harbour of Icod is at Puerto de San Marcos, where the small mole is used only by local and fruit boats.

The population gradually thins out to the west of Icod, and the four districts in the coastal strip have about 13,500 inhabitants. The relics of the destruction done by lava-flows in 1705 at Garachico are very apparent. Garachico (Photo. 46) was once the chief harbour of Tenerife and had many quays, palaces, and fine houses. Now only the church and the convents which escaped destruction give some indication of its former importance. The harbour is of little use, and the village is mainly dependent on its fields of sugar-cane, maize, and bananas which stretch almost without a break towards Buenavista. The small villages of Los Silos and Daute lie in this fertile countryside. Buenavista itself stands at the western limit of the north-coast region and is cut off from the south by the extremely dissected forested country which extends to the Punta de Teno. On the north-east the barren slopes of the Montaña del Taco rise to over 1,000 feet. The compact village is grouped around its church and plaza, and, with its district, has a population of 3,600.

Eastern Area. This region extends from S. Cruz to the neighbourhood of Arico and covers the lower slopes of the Cumbre and Las Cañadas. The population, which is markedly less dense than on the north coast, reaches a total of 23,700. Practically all the settlements lie within 4 miles of the coast and below the 2,000-foot contour. There are very few villages, however, near the shore, the main concentration of settlement being on the foothills between 2 and 3 miles inland.

Immediately south of S. Cruz there is much dispersed settlement over a countryside which lacks the luxuriance of the north coast but produces wheat, oats, and oranges in very small fields divided from each other by low walls. The first village of any size, El Rosario, lies to the west of the main road and is the centre for a district of scattered houses with 4,600 inhabitants. About five hamlets are fed from the small barrancos between El Rosario and Arafo. They overlook the coast where the fishing-village of Candelaria, very similar to S. Andrés, is placed at the head of a small bay. The village is the scene of a local pilgrimage to the statue of Our Lady of Candelaria; a full account of the origin of the legend concerning the statue is given by Espinosa in his account of the Guanches.

The village of Arafo is 2 miles west of the main road; it stands at 1,620 feet on tracks leading to the Pedro Gil pass, which gives access to the Orotava valley. About 2 miles to the south-east the town of Güimar has grown up between the precipitous slopes of the Ladera de Güimar, snow-covered in midwinter, and the low cone of the Volcan de Güimar which rises to 925 feet. The town is the largest settlement in the eastern region, and its district supports 8,500 people on the fertile volcanic soil, which gives three harvests a year of tomatoes, onions, and cereals. The houses are grouped around the main road, some lying to the south in the particularly productive valley of the barranco de Badajoz. There is a small out-port in the Puerto de Güimar, 3 miles to the south-east.

South of Güimar the density of population decreases, though the pattern of settlement is similar. Much of the land here is terraced and cultivated with great care. Near Fasnía there are still some cave-dwellings in use, excavated in the soft volcanic tufa. The village of Arico, which stands on the southern border of the region, is the centre for a large district with 4,300 inhabitants; the three villages here, of Arico Viejo, Arico Nuevo, and El Lomo de Arico itself, export part of their produce from the small anchorage at Puerto Abona.

Western and Southern Foothills. The western and southern regions of Tenerife are arid and mountainous, and the population does not exceed 22,200 in the whole area.

In the mountains of the west coast the settlements are small and dispersed; they are usually separated from each other by several deep barranco valleys, similar to those of Gomera. As a result the roads are usually poor, and the products are sent down to the small anchorages along the coast, which are visited when possible by the local steamers and fruit-boats. Santiago and Guía are the most important villages and are the centres of two districts of scattered settlement which together have 7,000 inhabitants.

In the southern region, as on the north coast, the dominating influence of the Pico de Teide is very apparent; here, however, the main zone of settlement is between 4 and 5 miles inland, where the aridity of the area can be overcome by irrigation from the barrancos. Owing to the difficulty of overland communication, however, most of the larger villages make use of the anchorages on the south coast to transport their produce, in the same way as the western villages.

Many small hamlets have grown up in the barranco valleys between Guía and Adeje, most of them well inland. Adeje itself was originally the centre for the large estates of the Counts of Gomera and was the

market for the sugar produced in the neighbourhood, with the help of slave labour. The town lies at 990 feet in the deeply cut barranco del Infierno, in a district whose 3,200 inhabitants depend mainly on the tomato crop. Steep-sided mountains over 3,300 feet high separate Adeje from Arona, second important centre for tomato production, which has an outport at Puerto de los Cristianos.

Communications are very poor between these villages and the eastern group around S. Miguel and Granadilla. S. Miguel is a loosely grouped village which stands on a slope at 1,930 feet and commands an irrigated fertile plain. It appears like an oasis in the arid mountainous country surrounding it, the volcanic structure of which is plainly revealed. Square paving-stones, known as *losas*, are quarried in the neighbourhood and sent to other parts of the island. Granadilla spreads over a small mountain-encircled plain and is one of the largest towns of the south, commanding a district with over 4,200 people. Where the land can be irrigated, cereals, tomatoes, potatoes, tobacco, and vines are grown. The town stands at the junction of the S. Cruz-Vilaflor road, with a motorable road to its outlet in Médano bay.

Vilaflor is the only settlement which lies on the upper slopes leading towards Las Cañadas; at an altitude of 4,543 feet it is within the fringe of pine-woods which still remain on the southern and western heights of the island. The village is the chief centre of the most sparsely populated district of Tenerife with 1,740 inhabitants. It is growing into a small mountain resort, owing to the coolness of its summer weather, but in winter it is often snow-covered.

Central Mountains. The population of Tenerife is entirely peripheral, the steep arid slopes of the Pico de Teide and Las Cañadas being entirely uninhabited. The Pico de Teide, however, is frequently visited by mountaineers and scientists, and the provision of guides and mules is a source of employment for the inhabitants of Villa Orotava, from which direction the climb is usually attempted. There is a rest-hut near the summit of the Pico, and an observatory in the eastern Cañadas, on the Montaña de Izana.

Industries

Mining and Manufacturing. The mining and manufacturing industries of Tenerife are unimportant. A little pumice is obtained from the base of the Peak and a little sulphur from its summit. In addition, there are numerous roadside diggings for building-stone, but the only large concern is the Jurada quarry, where large blocks

of blue basalt were dug and shaped for the mole at S. Cruz. A single-track railway, $2\frac{1}{2}$ miles long, runs from the quarry to the mole.

As all fuel for power purposes has to be imported, the manufacturing industries are small and mainly domestic. Drawn-linen work employs a great many women and hand-embroidery a few; cigars and cigarettes are made in several fair-sized factories at S. Cruz, while small windmills and a few motor-driven mills for grinding cereals occur near the main towns and villages.

Agriculture. The soils, the land utilization, and farming practices of Tenerife resemble those of Gran Canaria, there being the same terracing and the same search for water. As a rule, however, water is scarcer in Tenerife, with the result that although the crop acreages are usually greater than in Gran Canaria, the lower yields per acre cause the total agricultural production of the two islands to be about equal. In parts of Tenerife the effort applied in making land cultivable is almost beyond belief. Thus between Los Asientos and Fasnia the country is a succession of terraces, laboriously erected and filled with a soil of rotten pumice stone which retains moisture for a long period and allows of the production of large quantities of potatoes in a favourable season. Not a square yard is wasted; miles and miles of small triangles and rectangles, a few yards only in perimeter, with walls and soil of the same pale biscuit colour. This is a land of small proprietors who utilize their spare time in summer by building another terrace or two on the uncultivated slopes above. In the south, where estates are larger and owners cannot afford to hire labour solely for the purpose of terracing, the agriculture is less intensive.

The following table summarizes the agricultural production of the province of S. Cruz de Tenerife, which includes Tenerife and the smaller islands of La Palma, Gomera, and Hierro.

*Agricultural Production in the Province of Santa Cruz
de Tenerife, 1933*

	<i>1,000 hectares</i>	<i>Value in million pesetas</i>
Cereals	34·1	5·73
Legumes	6·2	1·84
Roots, tubers, and bulbs	4·1	10·75
Industrial plants	0·21	0·80
Horticultural crops (irrigated)	3·45	27·0
Plantations	3·50	43·8
Vineyards	4·09	2·36
Artificial meadows and forage crops	0·6	0·82
Pastures and rough grazing	160·1	0·11
Fallows and unplanted	0·8	0·28

The main cereals in 1933 were wheat, barley, and maize in the following proportions:

	<i>Hectares</i>	<i>Yield in metric tons</i>
Wheat . .	17,900	4,580
Barley . .	7,300	3,690
Maize . .	8,300	2,640

The bulk of the production comes from Tenerife, where the best cereal country is the La Laguna plateau which has an abundance of ground-water and a rich soil free from stones. During the same year about 6,000 hectares were under legumes (mainly beans) and a further 4,000 hectares under roots, fibres, and bulbs. The latter group is of considerable importance as it includes potatoes and onions. The potato harvest (46,000 tons from 3,865 hectares) is the chief in the Canaries, being far greater than that of Gran Canaria. The heaviest yields are obtained from irrigated areas, but a large acreage is grown on terraces without irrigation. In the terraced areas it is a common practice to dig caves for storage purposes. This category of crops also includes onions of the finest quality, and onion-seed of which there is an export to most parts of the world.

The chief of the horticultural or irrigated market-garden crops (3,450 hectares) is the tomato, the production of which slightly exceeds that of Gran Canaria and which forms 25 per cent. of the total value of the agricultural produce.

The tomato is exceeded in importance only by the banana, which in a normal year occupies between 2,500 and 3,000 hectares and provides an income of from 30 million to 40 million pesetas (Photo. 52). The other tree and bush crops are relatively unimportant as may be seen from the following table for 1933:

	<i>Hectares</i>	<i>Number of trees</i>	<i>Yield in metric tons</i>
Oranges . .	50	39,000	930
Lemons . .	27	18,000	390
Almonds . .	12	208,000	1,250

Tenerife is by far the leading island in the Canaries for vineyards (4,000 hectares), the supremacy dating back to before 1764, when 15,000 pipes of wine and brandy were exported. The white wines have lost much of their repute, but the vines still flourish on unirrigated slopes and amid the volcanic cinders, especially in the Valle de Orotava and on the hill-sides near Güimar. The normal method of manuring is to plant lupine between the vines in winter and to hoe it in during spring. The harvest in 1933 included 390 tons of

table-grapes and 3,700 tons of grapes for wine, or the equivalent of 23,000 hectolitres of must.

The decay of the wine trade is very similar to the collapse of the cochineal industry, which to-day produces a few tons only. This production, however, is not likely to die out entirely because of the very favourable conditions for cultivation and because the cactus on which the cochineal thrives grows in situations unsuitable for other plants. Moreover, cochineal is still used in the manufacture of rouge and lipstick, and also in silk-dyeing.

Livestock. Tenerife is poor in artificial and natural meadows, but possesses a large acreage of rough grazing and shrub, which supported, with the aid of leguminous forage crops, the following livestock in 1934:

Cows	.	.	.	20,000
Sheep	.	.	.	11,000
Goats	.	.	.	41,000
Swine	.	.	.	17,000
Horses	.	.	.	2,000
Donkeys	.	.	.	3,500
Mules	.	.	.	6,000

The main fodder plants are the escobón and codeso, leguminous shrubs that grow mainly at altitudes of 5,500 to 6,500 feet. The inhabitants of the villages on the north-western slopes of the Peak make long journeys to obtain sufficient for their stock. They cut large quantities and carry it in huge bundles on their heads down the steep mountain paths. Occasionally donkeys are laden with four or five well-stuffed sacks, and even young girls will carry a monster sack on their heads.

In addition to the livestock shown in the table there were in 1934 nearly 250,000 hens, a few thousand turkeys and ducks, and large numbers of pigeons and rabbits.

Fishing. S. Cruz de Tenerife is the headquarters of the western Canaries fishing region, in which during 1933 about 2,660 tons of fish were landed. The main species caught were mackerel, tunny, and hake. Since the bulk of the fishing is done by hook and line from small boats, the number of persons engaged is relatively great and usually exceeds 8,500. In 1933 the fishing-fleet at S. Cruz consisted of 1 steam vessel of 106 tons, 45 motor-vessels averaging 45 tons, 35 sailing-ships of nearly 50 tons each, and 1,300 small rowing-boats. The surplus fish is dealt with in 5 salting and 2 preserving factories which together employ 100 people and handle about 1,900 tons of fish a year.

Ports

The two main areas of dense settlement in Tenerife are the plateau of La Laguna and the Valle de Orotava. The first is served by the modern port of S. Cruz, and the second by the relatively insignificant Puerto de la Cruz. No other port in the island is regularly visited by large vessels.

S. CRUZ DE TENERIFE (Lat. $28^{\circ} 27'$ N., long. $16^{\circ} 15'$ W. Population 61,983 in 1930).

General Description. The city of S. Cruz stands on level ground between the barranco de los Santos and the barranco de Almeida. To the north and north-west the land rises within a few miles to the arid ridges of the Anaga peninsula, while on the west and south there is a more gradual ascent to the fertile plateau near La Laguna (Fig. 25). Its position in the north-east of Tenerife and in the lee of the Anaga mountains makes the harbour comparatively convenient and safe for shipping. The streets of the city are narrow but well paved and lit by electricity. Many of the houses have wooded balconies, shaded patios, and flat roofs with belvederes (*miradores*) reminiscent of eastern Spain (Photos. 49-51).

S. Cruz is the capital and military headquarters of the Canary Islands; after Las Palmas it is the largest port and town in the archipelago and in 1940 had a population of over 70,000.

History. S. Cruz rose to importance as the gateway to La Laguna, formerly the chief settlement of Tenerife. The mole was commenced soon after the arrival of the Spaniards and was repaired in 1585. Among the notable attacks on the harbour were that of 1656 when Admiral Blake, with 36 vessels, created great havoc and sank 16 galleons at their anchorage, and that of July 1797 when Rear-Admiral Nelson lost his right arm during an unsuccessful assault. In 1821 the Canaries became a Spanish province and S. Cruz was made their capital. Within the next seventy years the installation of submarine cables and a great increase in the banana trade and in international shipping caused a rapid growth of the port. Plans were made to improve the harbour, and the main breakwater, hitherto only a few yards long, was gradually extended. To-day the work of improvement still continues and is nearing completion.

Industry and Commerce. The main industries at Santa Cruz other than agriculture are coaling, oil-fuelling, ship-repairing, and ship-building. Manufacturing industries are small and are restricted to



FIG. 25. Plan of S. Cruz de Tenerife.
1. Plaza de la Constitución. 2. Cable hut.

1 factory for shoes, 1 for spaghetti, 2 for ice, at least 3 for tobacco, and 7 for salting or canning fish.

In 1933 the total weight of traffic handled was 820,000 tons, of which 75 per cent. consisted of imports. During this year 3,907 ships totalling 8,700,000 tons entered the harbour and 37,000 passengers, mostly from abroad, passed through the port. The chief exports were bananas, tomatoes, potatoes, almonds, and onions, and the chief imports were wheat, maize, flour, rice, textiles, artificial manures, sugar, hardware, and soap.

Detailed Description. The outer port or anchorage outside the harbour of S. Cruz has depths of up to 20 fathoms, but shoals uniformly to about 1 fathom near the shore. The approach to the harbour is deep and clear with 15 fathoms in the entrance. However, the harbour is partly open to winds from the north-east and a swell generally sets in because of the prevalence of easterly winds.

On the east the harbour is formed by the Muelle del Sur, which extends from near the Plaza de la Constitución, first 250 yards eastwards and then (in 1938) about 1,200 yards north-north-eastwards. On the north shelter is provided by the Muelle del Norte, which projects 150 yards south-eastwards from near the Fuerte de S. Miguel. The harbour thus sheltered is about 1,200 yards long by 400 to 600 yards wide, and ranges in depth from 1 to 14 fathoms, about two-thirds of the area having a depth exceeding 26 feet. On an average, spring tides rise 9 feet and neap tides 7 feet.

There is accommodation for 6 large ships alongside the Muelle del Sur and for another 6 at mooring-buoys. The daily capacity of the harbour is estimated at 2,700 tons of stores a day. The unloading facilities consist of several small cranes and one medium-size crane on each of the moles. A few steam-driven tugs and numerous motor-launches for passengers and lighters for cargo are available.

The length of quayage and depth of water alongside the Muelle del Sur are given in the following table:

<i>Length of quayage</i> (feet)	<i>Depth of water</i> (feet)
381	10
240	20
544	22
786	33
702	35
1,640	40

This mole is about 70 feet wide and is lighted by electricity. The Muelle del Norte is a new construction and is in much shallower water.



49. *S. Cruz de Tenerife*



50. *Port of S. Cruz de Tenerife*



51. *Port of S. Cruz de Tenerife*



52. *Banana plantation, Tenerife*

Port Facilities. There are no docks at S. Cruz, the main port facilities being 3 or 4 small slipways capable of taking lighters up to 200 tons. One of these is a patent slip for vessels up to 114 feet long.

Communications. An electric tramway for passengers and freight connects the Muelle del Sur with La Laguna (7 miles) and Tacoronte ($12\frac{1}{2}$ miles). There is also a short length of steam railway which runs from this mole along the harbour front and shore to the basalt quarries at Jurada, $2\frac{3}{4}$ miles to the north-east.

The main road connexions are westward to La Laguna and so to Villa Orotava, and south-westwards to Güimar.

Telephonic and telegraphic communications are maintained with the chief villages of Tenerife; radio connexions exist with Spain, and cable connexions with countries of western Europe and Africa (pp. 107-108). S. Cruz is already an important seaplane base.

PUERTO DE LA CRUZ (PUERTO OROTAVA) (Lat. $28^{\circ} 25' N.$, long. $16^{\circ} 32' W.$ Population 8,713 in 1930).

Puerto de la Cruz stands near the middle of the north coast of Tenerife. The town occupies the foot of a slope that rises fairly steeply within 2 miles to the winter resort of Villa Orotava (1,040 ft. altitude).

The harbour was at one time the centre of a flourishing wine trade and later of the cochineal industry; to-day it is mainly concerned with fresh fruits and especially bananas and tomatoes. A considerable number of vessels call to disembark visitors to the Orotava valley.

Ships usually anchor about three-quarters of a mile off shore from Puerto de la Cruz in 50 fathoms of water. The anchorage is well sheltered from south-easterly winds, but is exposed to winds from a northerly quarter. On the eastern side of the town there is a small harbour, where landing from small vessels is possible except during strong north-easterly or north-westerly winds. There are two short moles, the Penitente and the Municipal, each with one or two small cranes. The Penitente mole, which has a height of 15 to 20 feet according to the state of the tide, will accommodate a coaster of 200 tons; the Municipal mole can be used by coasters and lighters except during strong north-easterly winds.

The only good inland connexions of Puerto de la Cruz and Villa Orotava are by road north-eastwards to S. Cruz (26 miles) and westwards along the north coast to Icod and beyond. A steep, winding road suitable for motor traffic leads southwards to the Cañadas depression at El Portillo. The port has communication by telephone and telegraph with the main towns of Tenerife (Photo. 47).

Communications

Roads are the chief means of inland communication in Tenerife; there is, however, an electric tramway along the main road from S. Cruz to Tacoronte ($12\frac{1}{2}$ miles) and a short stretch of single-track railway from S. Cruz to the Jurada quarries. The local steamers and fruit-boats supplement the inadequate system of roads in the south and west of the island.

The roads are similar in type to those of Gran Canaria; many of them are winding, undulating routes, continually bridging deep ravines, but they are well engineered and used by heavy motor traffic. The main roads are built on rock foundations with tar-macadam surfaces and good width. At present there are probably not more than 190 miles of first-class roads, but considerable progress has been made by the military authorities since 1939 in converting the old unmetalled roads known as *pistas* for modern traffic. In normal times the roads are used mainly by the local omnibus services which serve most of the villages in the north and east and by fruit lorries. As in Gran Canaria, mules are used as pack-animals in the mountains; horses are now very scarce in the island.

Road Network. The main roads are at present designed to serve the coastal districts. The basis of the road network is the route round the island which can be used throughout by motor transport but has an unmetalled narrow section between Puerto de S. Juan and La Somodita (near S. Miguel). This will probably soon be improved, and the coastal route will then be complete. At present the section from S. Cruz to Santiago is known as the Main North road, whilst the section round the south and west, including the *pista* road, is the Main South road. Practically all the larger settlements lie on this route, or on short branch-roads, many of which are also in first-class condition.

An interesting recent development of the road system is the attempt to cross the uninhabited arid centre of the island, around the Pico de Teide itself. These roads have been planned and constructed mainly by the military authorities. The most important is that between Villa Orotava and Vilaflor, the northern section of which is completed as far as El Portillo pass.

Main North Road. This road is used by local agricultural traffic and has a tar-macadam surface which is capable of taking loads up to 9 tons. There are about 55 crossings of gullies and barranco beds along the road, and one short tunnel through a lava-flow to the west of Icod. The construction of the road was begun in 1852,

and it has proved an important link between S. Cruz and the densely populated agricultural region of the north coast.

Between S. Cruz and Tacoronte the road utilizes the passageway between the mountainous Anaga peninsula and the Cumbre. On leaving S. Cruz it winds up to 960 feet at La Cuesta (4 miles), where the power station for the electric tramway is built. The climb continues to La Laguna ($5\frac{1}{2}$ miles) and thence to the watershed at 2,066 feet. Low volcanic hills extend on the north, as the road descends past orchards, terraced fields, and several hamlets to Tacoronte ($12\frac{1}{2}$ miles), the terminus of the electric tramway.

The road follows the coast between Tacoronte and Icod and is nowhere more than $1\frac{1}{2}$ miles inland. It crosses a countryside where the terraced hill-slopes are dissected by numerous ravines descending steeply to the sea. Beyond La Victoria de Acentejo (17 miles) a new steel bridge, 125 feet high, crosses the barranco Hondo, avoiding a winding detour to S. Ursula. The main road then runs below Villa Orotava, which lies on the slopes of El Teide, 1 mile to the south, and continues to the junction with the Puerto de la Cruz road at Ramal de las Arenas ($24\frac{1}{2}$ miles). The Realejo villages stand on the valley to the south, as the road approaches the cliffs and enters S. Juan de la Rambla ($32\frac{1}{2}$ miles). A gradual ascent leads thence to the fertile countryside near Icod ($37\frac{1}{2}$ miles).

Beyond Icod the road bears away from the coast and climbs in wide curves to El Tanque, and through more open country to Ruigomez ($45\frac{1}{2}$ miles). The route now lies southwards between the dissected mountains of the Teno peninsula and the higher slopes of the Pico de Teide. The highest point on the road is reached at Cumbre del Valle at 3,430 feet, whence a winding descent into the Valle de Santiago leads to the village of Santiago del Teide ($50\frac{1}{2}$ miles).

An important branch-road from Icod continues the coast section of the main road through Garachico to Buenavista (10 miles), beyond which it rapidly deteriorates. The other main branch-roads penetrate for short distances into the Anaga peninsula. Along the southern coast of the peninsula a corniche road from S. Cruz winds along the coast to S. Andrés (5 miles); it was reported in 1942 to have been extended to Igueste. From La Laguna a motor-road winds directly into the peninsula following the barranco de las Mercedes, above which it climbs to the hermitage of S. Maria del Carmen at 3,000 feet. At this point it is possible to see the whole of the valley of La Laguna, the coastline near S. Cruz on the south and at Bajamar

on the north, as well as the central mountains and the Pico de Teide. This road is also connected with a macadam coast road from Tacoronte through Bajamar, terminating at Punta Hidalgo.

Main South Road. The route skirts the hills behind the east coast before striking into the southern mountains. Most of the surface is of macadam, similar to that of the Main North road, but the *pista* section is unmetalled and sometimes becomes slippery. As a whole, the route is winding and undulating, particularly beyond Arico. There is a tunnel 1 mile north of the village of Arico Viejo.

The construction of the road began in 1864, and originally the route branched south at La Cuesta. Now, however, it runs direct from S. Cruz and joins the old road 5 miles to the south near the Montaña de Taco. The general level of the road lies between 500 and 800 feet and the villages stand on the hills to the west. Two streams of lava are passed as the road turns inland to the valley of Güimar (20½ miles). Beyond the town there is a steep climb of 300 feet up the volcanic wall of the Ladera de Güimar (23 miles). Thence the road keeps about 2 miles inland past Escobonal (28½ miles) and across the barranco de Herques to Fasnía (31 miles). A winding descent, with several hairpin bends, leads across fourteen barrancos and gullies through Arico Viejo (39 miles) to El Lomo de Arico (40½ miles).

Beyond Arico the road, which has gradually been turning inland, turns definitely to the west towards Granadilla (54 miles). Beyond La Somidita, which is the junction with the road from S. Miguel, the unmetalled *pista* winds across deep barrancos and mountain sides to the Puerto de los Cristianos (70 miles). A narrow track leads thence along the coast across twenty gullies to the hills above Puerto de S. Juan (87 miles). The road surface improves here, as the road rises inland past the junction with the road from Guia to the village of Chio (97½ miles). The ascent continues to over 3,000 feet, whence the road enters the valley of Santiago and meets the Main North road at Santiago del Teide (102 miles).

As this road serves the coastal regions of the east, south, and west there are many cross-connexions from the villages and the anchorages along the coast. The chief of these is that from Médana bay to Granadilla, which crosses there the Main South road and continues north to Vilaflor.

Mountain Roads. The Villa Orotava–Arenas Negras road has been constructed by the military authorities and is later to be extended from Arenas Negras to Vilaflor. It must always have more strategic than economic value.



FIG. 26. Communications and Settlements of Tenerife

From Villa Orotava the road climbs the mountain-side by wide well-engineered curves. It passes an electric station at Agua Mansa (7 miles) and continues to climb, leaving the Montaña Bermeja on the east which rises to 4,300 feet (11 miles). The ascent continues to the defile of El Portillo at 6,562 feet ($17\frac{1}{2}$ miles), where a road-mender's hut marks the end of the motorable road.

A second military road from La Laguna to the Villa Orotava road at Arenas Negras is roughly completed. It passes first through the Esperanza forest and passes the summit of Pedro Gil to the meteorological observatory on Montaña de Izana. Traversing the high arid volcanic plateau it then turns west towards the Orotava road.

GOMERA

PHYSICAL GEOGRAPHY

Relief

The island of Gomera is almost circular in shape, its maximum extent being $15\frac{3}{4}$ miles from north to south and 13 miles from east to west. It covers about 172 square miles and topographically is in many respects a miniature of Gran Canaria. The coasts are steep, especially on the west, and the interior has been fashioned by surface-water into a flattish dome whose flanks are dissected by deep barrancos (Fig. 27).

The nucleus of the island is the volcanic mass of Garajonay, a convex upland which attains nearly 5,000 feet in Alto Garajonay and exceeds 4,000 feet in the area between La Laguna (4,134 ft.), La Fortalaza (4,061 ft.), and Paredes (4,425 ft.). This highland is distinctly mountainous and is difficult of access, especially when clouds and mists form upon it. The slopes to the sea are everywhere steep, since Alto Garajonay itself lies at 5 to 9 miles from the coast. These declivities have been eroded by running-water into an alternation of mountain spurs and deep barrancos. The spurs are not uncommonly razor-backed, although on the extreme west where dissection has been less active they become vast buttresses. The greatest spur runs eastwards from Las Nieves, and declining through Tagasniche (3,218 ft.) and Langrero (1,253 ft.) terminates at the outskirts of S. Sebastián; it acts in many ways as a medial ridge, and provides the main routeway from the capital to the centre and west of the island. The valleys are miniatures of the vast chasms of Gran Canaria, and although they seldom exceed 4-5 miles in length, they are commonly incised 1,000 feet or more below the general level of the intervening spurs. Among the larger barrancos are those of Vallegranrey on the west, Erque and Santiago on the south, of Villa on the east, and Hermigua on the north. The precipitous sides of these ravines present an impassable obstacle to transverse communications, while routes using the barranco floor have to surmount the steep walls at the head of the gorge. Only on the south and east is it usual for the barrancos to open out to small beaches at their mouths; the chief exception to the rock-bound nature of the north coast is the valley near Hermigua which is about half a mile wide between the steep, enclosing cliffs.

Drainage and Water-supply

Gomera has an ample supply of water, much of which is used for agricultural purposes. The drinking-supply comes from springs and, where necessary, from rain-water, but water for irrigation is usually provided by sources in or at the heads of the barrancos. Although the greater soil and vegetation cover of Gomera assures a less rapid run-off than in most of the other islands of the Canaries, the beds of the barrancos (38 of which reach the coast) are usually waterless in the drought season. Yet they may contain copious streams in time of rain. Very typical is the following account of the descent of the barranco at Hermigua, in March after five weeks of heavy rain. 'The little rivulets which came tumbling down from the higher mountains now joined to form fast-running mountain streams until, at Hermigua Alta (c. 1,000 ft.), a swift stream was coursing down the middle of the valley, rushing over the boulders in a swirling torrent, reminiscent, except for the bamboos and coarse vegetation, of a Dartmoor stream.' The main storms may occasionally be heavy enough to cause disastrous floods, as happened early in November 1941 when sudden spates destroyed hundreds of houses in the island. Even in the dry season the vegetation of these barrancos is remarkably green. Thus, the bed of the steep barranco behind S. Sebastián consists for much of the year of a wide, dry watercourse or a series of channels filled with large water-worn boulders. Yet parts of the valley-floor are enclosed for agriculture, and the most striking feature is not the empty watercourse but the green slopes rising above it.

The island also has numerous springs, which occur, for example, beside the track from San Sebastián to Las Nieves and at La Fuente Santa (2,200 ft.) north of La Laguna near the route to Vallehermoso. Fresh water from springs is piped to the cable transporter on the north coast at Puerto de la Piedra Rosa.

Vegetation

The plant-cover of the cloud-belt of Gomera is denser and more continuous than that of any other island of the Canaries. However, the lower areas of the island are semi-arid, the hills being bare of trees and the natural vegetation consisting mainly of euphorbias and of fleshy-leaved clusters of *Sempervivum*. Near the foreshore in some parts there is a narrow fringe of tamarisk, but the predominant features of the vegetation on the lower levels are the banana plantations and date-palms of the irrigable valley bottoms.

The dense plant-cover of much of Gomera provides shelter for some birds that have been almost exterminated in the more arid islands of the archipelago, and especially for the partridge, which is much more common here than elsewhere in the Canaries.

Coasts

The coasts of Gomera are rugged and precipitous; the cliffs rise perpendicularly in places to 980 feet and are deeply incised by thirty-eight barrancos, at the mouths of which are small pebbly beaches. There is no harbour in the island, but S. Sebastián on the east coast has a sheltered roadstead.

The east coast from Punta Majona to Punta del Becerro, a distance of 16 miles, is steeply cliffed in the north but opens out in the south at the mouths of the small streams. The port of S. Sebastián lies to the south of Punta S. Cristóbal, there being no mole, except for a jutting outcrop of volcanic rocks which is used as a landing-place. There is a beach about 210 yards long, made up of stones and black volcanic sand, in front of the town. A description of the roadstead is given on pp. 174-175. A road winds inland for about 4 miles from S. Sebastián, but communication beyond with the villages of the north coast is by rough tracks over difficult country. The other landing-place on this stretch of coast is at the village of Santiago, which lies above a beach backed by rugged treeless hills. There is a road about 3 miles long, leading inland to Alajero, but other communications are by tracks. An anchorage also lies on the eastern side of Punta del Becerro.

Almost continuous and inaccessible cliffs line the 20 miles of western coast to Punta de los Organos, a headland formed by upright basaltic columns, which in their remarkable regularity resemble the pipes of an organ. There are few villages near the cliff-edge, and only tracks link the area with the rest of the island. The best anchorages are in the bay of Cantera (Cala Cantera), which is used by tunny-fishing boats, in Argaga bay, where a road from the beach leads up the Vallegranrey, and in the Playa del Inglés.

The northern coast has steep cliffs with beaches at the mouths of the ravines. The valleys which lie behind the coast are very fertile and produce large quantities of bananas and tomatoes for export. Owing to the difficulty of overland transport, cable transporters known locally as *pescantes* have been built from the cliffs to facilitate this trade. In the west of this coast a steam-worked transporter serves the Vallehermoso area. A second transporter, worked by

hand, lies 4 miles to the east at Puerto de la Piedra Rosa in the shelter of Piedra Rosa point to serve the village of Agulo; a third, a Temperley transporter, is at Peñon and acts as the port for the Hermigua valley. The fruit-crates are brought down to the coast by porters or camels, the steamers lying off shore and being loaded direct from the transporters (Photo. 53).

HUMAN GEOGRAPHY

Distribution of Population

In 1930 the total population of Gomera was 26,703, and thus there were about 180 people to the square mile. The larger settlements, except for S. Sebastián, lie in the valleys along the north coast. The centre and south of the island are sparsely peopled (Fig. 27).

The capital and port of S. Sebastián is surrounded by steep-sided hills, so that the hamlets nearby are concentrated in the valleys of the Seco and Aguajillo barrancos which supply the town with water. These valleys, which trend north-west from S. Sebastián, are densely peopled despite the mountainous nature of the country. Westwards, however, the houses thin out on the upper slopes of the Enchereda and Tagasniche mountains.

The three valleys which cut deeply into the mountains of the north coast are followed by continuous ribbons of settlement and cultivation. The eastern valley is centred on the small town of Hermigua, set in the mountain-encircled valley about one mile from the sea. There are only a few houses near the little creek of Peñon, where the bananas and tomatoes of the valley are exported. Small groups of houses extend for about $2\frac{1}{2}$ miles up the terraced valley, placed amidst palms, orange-trees, vineyards, and plantations of bananas. Agulo, the largest village, dependent on a second barranco about one mile to the west, stands above the cliffs at 650 feet and overlooks the small boat-harbour and cable transporter of Puerto de la Pedra Rosa. This barranco has valley-sides formed of perpendicular basaltic columns in places, so that cultivation is limited to the floor of the valley. Tomatoes, bananas, almonds, vines, cereals, flax, and palms are grown on this limited space and give an appearance of great fertility to Agulo. The western valley around Vallehermoso is the largest of these strips of settlement, which extends here from the cliffs about 4 miles inland. The centre of the valley is the town of Vallehermoso, which lies about $1\frac{1}{2}$ miles from the coast. The town has an older quarter placed on the higher slopes, whilst the newer



53. *The transporter at Peñon, Gomera*



54. *Banana plantations in the valley of Hermigua, Gomera*



55. *Terraced banana plantations at Hermigua Alta, Gomera*



56. *S. Sebastián, Gomera*

houses are built below, amongst tall palm-trees. Facing the town is the bare crag of Cañón, a monolith which rises to nearly 800 feet. The houses along the rest of the valley are usually built near the bed of the barranco, below the precipitous slopes of the ravine. Tomatoes and bananas are produced for export and are taken down to the cable transporter at the mouth of the barranco (Photos. 54-55).

The settlements on the south of the island are very scattered and are isolated by the steep-sided mountains which cover the whole area. On the whole, the villages are larger and more numerous in the south-west than in the south-east. In the south-west the Vallegranrey repeats on a smaller scale the dense settlement along the north coast valleys. The chief village in the valley is La Calera, near the coast. In the interior of this part of the island a few small hamlets have been built above the Vallegranrey, but the main settlement is Chipude, a village of about 120 inhabitants lying at the foot of Garajonay and La Fortalaza peaks. It produces wines and figs and is the centre for about eight small hamlets. Alajero, a second village situated amongst the mountains, cultivates vines, cereals, and fruits and has the advantage of a road connexion to the anchorage off Santiago. The south-eastern corner of the island becomes increasingly arid and sparsely peopled. There is no village near the coast except for the small centre of Santiago, and inland Las Nieves and four small hamlets are the only settlements.

Industries

Apart from the one small boat-building yard at S. Sebastián, which employed four men and produced one vessel of 13 tons in 1933, the industries of Gomera are entirely concerned with agriculture and fishing. The former domestic weaving of wool has been discouraged by the import of cheap cloths, and the wool production, like that of silk, has become insignificant.

However, agriculture continues to flourish since the soils are fertile and water for irrigation is fairly abundant. The island is self-supporting in essential foodstuffs and has a surplus of some products. Wheat, barley, and maize are cultivated near the villages and in the fertile north small quantities of wheat are exported. The chief agricultural products are tomatoes and bananas which are cultivated mainly in the northern areas between Vallehermoso and S. Sebastián, and in the larger barrancos of the south. In most years several thousand tons of tomatoes and about 50,000 bunches of bananas are available for shipment. Frequently, too, there is a surplus of potatoes,

the bulk of the crop coming from the south near Alajero. Dates ripen well on the island. Most of the date-palms are to be found near S. Sebastián, where an alcoholic wine is made from the fermented juice of the overripe fruit. Vineyards are common near Agulo and Chipude and to a smaller extent near Vallehermoso, Hermigua, and Alajero, but the acreage under vines has decreased in late years and the output does not meet the local need. Other fruits, such as oranges, lemons, and figs, flourish on a small scale.

There are stretches of pasture in the north of Gomera and smaller patches elsewhere, while some of the scrubs afford browsing for goats and cattle. The rearing of pigs and cattle is carried on for local markets, and goats are fairly common, several thousand goatskins being formerly produced annually. Ponies and horses are used for riding, but camels, now bred on the island, do much of the carrying work.

The sea off the southern and eastern coasts of Gomera abounds in fish, and especially tunny. The surplus catch is sold to the salting factories at S. Sebastián, Santiago, and Vallegranrey or to the large canning factory at La Rajita. The latter establishment employs several steam-driven vessels of 100 tons each and has a modern ice-making plant with a capacity of 100 tons of ice a day.

Ports

A considerable share of the trade of Gomera is done by means of the *pescantes* or cable transporters at Vallehermoso (steam), Puerto de la Piedra Rosa (220 ft. long, 42 ft. above sea; man-power), and at Peñon (90 ft. above sea; steam). S. Sebastián, however, is the only port of the island and the only frequented anchorage.

S. SEBASTIÁN. (Lat. 28° 05' N., long. 17° 06' W. Population 6,051 in 1930.)

The town stands on the eastern side of the bed of the barranco de Aguajada and is sheltered on the north by the volcanic hills of Matanza (873 ft.). The settlement consists of three parallel streets of whitewashed houses which stretch from the shore for about half a mile up the wide, green, treeless valley (Photo. 56).

The so-called port is nothing more than the small sandy bay lying at the mouth of the barranco about one mile south-west of Punta de S. Cristóbal. The outer anchorage near the entrance to the bay has 10 to 15 fathoms of water, but is exposed to south-easterly winds and cannot offer much security in November and December. There is,

however, an inner anchorage within a small, well-protected creek (Puerto de la Hila) in the northern part of the bay. The method of discharging goods and passengers is by boat to the landing-stage at Puerto de la Hila or by boat to the beach in front of the town. Only small boats can approach the landing-stage and the beach. There are no quays and no unloading facilities apart from man-power, nor any supplies apart from fresh water and local foodstuffs.

The town's chief claim to fame is as the last stopping-place of Columbus on his first voyage across the Atlantic. The small fleet anchored here, taking in water and provisions, from 12 August to 6 September 1492, and the house where Columbus lodged and the church where he heard mass are still to be seen. Near the beach is a three-storied tower, about 50 feet high, built in the fifteenth century. This structure, with its massive walls 7 feet thick, served for centuries as the main defence of the bay, which was considered the only place in the island where it was practicable to land an invading force. To-day S. Sebastián is an agricultural town with a boat-building yard (4 employees in 1934) and a fishing industry that supplies a local salting factory. The main exports are tomatoes (in crates) and bananas, while the chief imports, although not specified, are manufactured goods.

Inland the country is rugged and the only good road leads north-westwards to Hermigua and Agulo, whence a track proceeds to Vallehermoso. Submarine cables run to Tejita in Tenerife and Puerto del Hierro in Hierro. S. Sebastián is visited by inter-island steamers only, the distances involved being 44 nautical miles to Puerto del Hierro, 50 miles to S. Cruz de la Palma, and 65 miles to S. Cruz de Tenerife.

Communications

The island of Gomera has no railways and only very short stretches of road which follow the direction of the larger valleys. Communication between the main villages is either by long, narrow, and winding mule-tracks or by boat between the coastal villages. This poverty of inland communication is due mainly to the height of the interior, and to the depth of the barranco valleys, which often necessitate long detours. It is advisable to climb up to the watershed, behind the north coast valleys to reach Hermigua, Agulo, or Vallehermoso from S. Sebastián, rather than to follow coastal tracks.

The most important route of the island joins S. Sebastián with the small valley towns of the north coast, and in places roads have

replaced the mule-tracks. The best section of road leads for 4 miles up the valley of the barranco Aguajillo, west from S. Sebastián. The next section of the route has long been scheduled for construction and may have been completed. If so, it runs past the hamlet of Aguajillo, tunnels under a spur of the Enchereda mountains, and descends into the Hermigua valley. The track takes a higher route, amongst wooded country at 3,000 feet, before joining the road at the head of the Hermigua valley. A road runs down the fertile and densely peopled valley to the coast, and connects it with the cable transporter at Peñon. The main road branches off before reaching Peñon, and winds westwards round a projecting spur to the village of Agulo. The journey from Agulo to Vallehermoso is by mule-track. The track passes Las Rosas hamlet and climbs above the Simanco barranco, before descending to the town and valley of Vallehermoso. Here a stretch of road follows down the richly cultivated valley to the cable transporter on the coast. The journey between S. Sebastián and Vallehermoso is only 17 miles long but takes at least 10 hours.

An alternative route between these two towns runs across the sparsely peopled wooded centre of the island. The track climbs directly above S. Sebastián, and within 4 miles reaches 2,300 feet. The steep gradient continues to the foot of Garajonay mountain (4,590 ft.), where the track turns due north across wooded country commanding wide views of the whole island. Beyond the hamlet of La Laguna the route descends the barranco to Vallehermoso.

The other stretches of road in the island are very short. The first joins the south-eastern coast at Santiago to Alajero, and the second barranco the west coast near La Calera to the irrigated lands in the lower $1\frac{1}{2}$ miles of the Vallegranrey.

LA PALMA

PHYSICAL GEOGRAPHY

Relief

La Palma is a mountainous island with a maximum length of 29 miles, a maximum width of $17\frac{1}{4}$ miles, and an area of approximately 318 sq. miles. It has been formed around a large volcanic crater, La Gran Caldera de Tabouriente, the rim of which culminates on the northern side in the Roque de los Muchachos (7,746 ft.) and the Pico de la Cruz (7,740 ft.). The outer rim of the crater does not form normal circular ramparts but is prolonged south-westwards and southwards in high, steep ridges and is breached on its southern edge. The western extension forms El Time, a mighty precipitous cliff of black volcanic rock; the southern extension forms the abrupt ridge of the Cumbre Nueva and Cumbre Vieja which terminates at the southernmost tip of the island (Fig. 28).

The Gran Caldera is the widest and deepest crater in the Canaries, its diameter varying from 3 to $4\frac{1}{2}$ miles and its depth from 5,500 to 6,500 feet. The breach on its south-western side is occupied by the barranco de las Angustias, which rises high up on the crater rim and continues with slowly increasing width 9 miles to the sea. The upper part of the inside of the crater consists largely of precipices of from 2,000 to 3,000 feet in height; the floor of the crater proper lies at about 950 feet above sea-level and is furrowed in parts by deep ravines which unite in the barranco de las Angustias. This barranco is a vast corridor ending seawards in a narrow stretch of lowland that also forms the mouth of the barrancos de Los Llanos and Tenizca (Photo. 57).

The northern half of La Palma island consists mainly of the outer slopes of the Gran Caldera. The relief here has the conical nature typical of vulcanism and the gradients are steep (average 1 in 4), especially towards the crater rim. The slopes are broken locally by secondary cones and have been dissected by barrancos into an alternation of gigantic spurs and narrow canyons, often 1,000 feet deep. The abrupt relief continues right to the coast, there being no coastal lowlands and practically no flat land except in the neighbourhood of Santa Cruz.

The topography of the southern half of La Palma contrasts markedly with that described above. South of a line from Tazacorte to Breña Baja, the relief consists of a narrow, central ridge, which maintains



FIG. 28. *La Palma*
Relief shown by form lines

a height of 5,000 feet to 6,600 feet over much of its length and drops very steeply (average 1 in 4) on each side to the sea. These slopes are occasionally broken, as in the north, by isolated minor cones, but

valleys cut by running water are almost absent, there being only one barranco in the whole area. The flanks of the Cumbre Vieja in the southern parts of the island bear evidence of recent volcanic outbursts; near Tigalate and Flores on the east, and on all the western slopes south of S. Nicolas de las Manchas, the surface is a succession of naked grey lava streams. Just south-west of Fuencaliente is a cindery, sulphur-streaked crater, about 250 feet deep, that was formed during the violent eruptions of 1677 (Photo. 58).

Drainage and Water-supply

There are about 37 barrancos in La Palma, and 36 of these occur north of a line from Tazacorte to Breña Baja. The small catchment basins of these valleys and the extreme steepness of their beds cause their periods of water-flow to be very brief, a sudden run-off or spate in time of rains being followed by long periods of utter dryness. Consequently, the greater part of the island is forced to rely for drinking-water on the rainfall, which is carefully stored in tanks and reservoirs. Some towns and villages, such as S. Cruz, Los Sauces, and S. Andrés, also obtain supplies from springs on the periphery of the crater.

The interior of the Gran Caldera is the best-watered part of La Palma and supplies from its copious springs are carried in stone channels (*atarjeas*) to Los Llanos, Argual, Tazacorte, and nearby villages. The surplus water, when there is any, runs away in the bed of the barranco de las Angustias, down which cultivation spreads like an ever-opening fan. Los Llanos and the higher villages east of it are not so bountifully supplied with water as the lowlands at the mouth of the barranco. El Paso, almost on the flanks of the Cumbre, obtains a supply from a local spring and from a tunnel, 256 yards long, driven into the wall of the Caldera at La Cumbrecita (3,800 ft.), the water thus obtained being fed to the natural watercourse leading past the village. Much of the Gran Caldera and its western slopes are covered with forest, which is thought to be largely responsible for the conservation of the moisture which here may usually be found just below the surface in sandy places. A great deal of the underground water filters through into the sea at short distances from the coast.

The main springs, permanent or intermittent, elsewhere in the northern half of La Palma are as follows: two springs a few miles north-east of Tijarafe; several good springs in a barranco south-west of Los Sauces, whence the town obtains its supply; and Fuente Nueva, a spring which is usually flowing, just beyond El Llanito de la

Barrera (3,850 ft.) on the track from Miraflores to the Pico de la Cruz. In addition, the S. Cruz area obtains large quantities of water from sources from the mountain slopes by means of covered-in aqueducts and iron pipes, there being a stone and a wooden aqueduct in the barranco del Río; and on the Pico del Cedro (c. 6,300 ft.) there are pits where the winter snow of the highest peaks is stored for summer use.

The southern half of the island is more arid than the northern. A spring in the upper barranco Aduares supplies the neighbourhood of la Breña, and there is a less persistent source near the head of the barranco running east from Monte Cabrito. The summit of the Cumbre Vieja is normally waterless, but on its extreme western flanks, near the sea below S. Nicolas de Las Manchas, there are mineral springs with medicinal qualities, the water of which runs away below the rock at low tide.

Vegetation

La Palma is one of the greenest and best-watered islands of the Canaries. Wooded scenery is common, and since deforestation has taken place much less than in Tenerife or Gran Canaria, *Pinus canariensis* still covers a large area. Generally speaking, the flatter and more fertile areas up to about 3,000 feet are cultivated, the main zone of cultivation being between 1,000 and 2,000 feet altitude. Below 1,000 feet some of the drier areas of the east, as near la Breña, and the more recent lava-flows on this side of the island support a covering mainly of heather, laurel, cistus, and euphorbia. On the mountain slopes between 3,000 feet and 4,000 feet which are affected by the lower layer of clouds, the vegetation consists mainly of laurel, faya, tree-heath, and bracken. From 4,000 feet to about 5,000 feet, pines with an undergrowth of bracken, and in parts of codeso, predominate. In some areas, as near Las Caletas, the pines grow amid grassy glades. Above 5,000 feet the Canary pine forms the chief plant and there is practically no undergrowth. The mature *Pinus canariensis* is usually 25 feet to 35 feet high, but in exceptional cases reaches nearly 100 feet in height and 20 to 25 feet in girth. Among the finest pine forests are those on the flanks of the Cumbre Nueva and in the central crater of Gran Caldera; the sides of the deep ravines incising the floor of this vast crater are shaded by pines that shed their needles in a thick slippery carpet which renders passage among the rocks difficult or even dangerous.

Coasts

The island of La Palma has no good harbours, the best being that of Santa Cruz, midway along the east coast. The shores as a whole are inhospitable, particularly in the north and north-west, where high cliffs drop sheer to the sea. These, however, appear insignificant in comparison with the central volcanic crater, which rises to nearly 7,500 feet.

The east coast stretches for 30 miles between Punta Cumplida and Punta Fuencaliente, the main bay being that on which Santa Cruz stands. To the north of the town, ten steep-sided barrancos enter the coast, which is formed by abrupt cliffs. Santa Cruz is built in an amphitheatre of hills, rising between 3,300 feet and 4,900 feet, in a sheltered position at the northern end of the sandy Playa de Bajamar. A long mole forms the main protection for vessels, which is adequate except in southerly or south-easterly gales (p. 185). South of Santa Cruz the coast is formed by beach-fringed cliffs, the seaboard becoming increasingly arid and desolate.

The other coasts consist almost entirely of high cliffs, the western coast extending in a north-westerly direction from Punta Fuencaliente to Punta Gorda, and thence north-east to Punta del Mudo, from which the rocky north shore extends for 10 miles to Punta Cumplida. The cliffs are very steep, falling in places sheer from 1,100 feet to the sea. There are some remarkable caves near the shore, including the Cueva Bonita, 5 miles south of Punta Gorda, which is 276 feet wide, 33 feet high, and has two broad entrances. One extensive beach, that of Tamanca, lies in the south-west, but off-lying rocks make it very difficult to approach. The only anchorage off the western coast is near Tzacorte, the outlet for the fertile valley of las Angustias, which is connected by motorable road to Santa Cruz round the coast, or by direct tracks across the central Cumbres.

HUMAN GEOGRAPHY

Distribution of Population

The total population of La Palma was 48,620 inhabitants in 1930, and thus it is the third largest of the Canaries, in number of population. The average density of population is about 162 to the square mile, which is considerably less than that of Gran Canaria and Tenerife. Most of the villages lie near the coast, owing to the height and steep slopes of the Gran Caldera and the central ridges. There are, how-

ever, only two areas in which there is any concentration of settlement; around S. Cruz, on the eastern coast, and in the neighbourhood of Los Llanos. The more mountainous northern section of the island is very sparsely peopled (Fig. 28).

Volcanic hills rise steeply behind the harbour of S. Cruz so that the neighbouring villages lie on the slopes of the barranco valleys. The town and port of S. Cruz itself are described on p. 185. The nearby hamlets of Las Nieves and Miraflores occupy the valley of Las Nieves barranco, their houses scattered amongst cultivated fields and plantations. South of S. Cruz the lower slopes of the hills are barren, but again at Buenavista small houses are spread far apart over a pleasant cultivated valley. The villages of Breña Baja and Breña Alta, which with their two districts have about 5,500 inhabitants, extend over the fertile slopes of the mountain of Breña. These settlements, with the village of Mazo to the south, have the advantage of easy access to S. Cruz.

The countryside between Mazo and Los Llanos can only be cultivated in favoured areas, where the volcanic soil is comparatively well decomposed and fairly level, and the water-supply is sufficient. The eastern edge of the mountains has the greater number of villages, including El Calvario, Flores, and Fuencaliente. The vineyards near Fuencaliente are quite extensive, and the district has nearly 2,000 inhabitants. The western slopes are arid and monotonous, S. Nicolas de las Manchas being the only hamlet till at Tajuya the fringe of the irrigated land near Los Llanos is reached.

Los Llanos is the centre of an oasis of settlement and cultivation, bordered on the north-west by the precipitous heights of El Time, and on the north and east by the walls of the Gran Caldera and the Cumbre Nueva. It is fed by the three barrancos of Angustias, Los Llanos, and Tenizca, and the fertility of the volcanic soil is shown by the variety of cultivation, including almonds, oranges, bananas, tobacco, sugar-cane, coffee, and tomatoes. Los Llanos itself is the market centre for the valleys and commands the fan-shaped area of cultivation which descends to the coast at the outport of Tazacorte. Its district has about 5,800 inhabitants, many of the people living in cottages near their fields on the valley slopes. The adjacent village of Argual was first founded by Belgian colonists, and traces of this origin remain in its buildings and the surnames of the people. Farther inland on the barranco de los Llanos lies the large village of El Paso. The increase in height is compensated by the good water-supply, and there is a wealth of fruit-trees as well as cultivated fields. The

houses have large gardens, and the village extends for over a mile along the road from Los Llanos. The district of El Paso, which includes some of the highest settlements in the island, has 4,900 inhabitants (Photo. 59).

In the north of the island the hamlets are small, sparse, and isolated. They are somewhat more numerous on the east than the west coast. Puntallana, on the east, is the terminus of the motorable road from S. Cruz, and the village with its district has over 2,300 inhabitants. The church of the village stands at 1,300 feet, but the village lies in a barranco valley about 150 feet lower down. A hamlet, El Granel, lies above the main village, in the same valley, surrounded by fewer orchards than Puntallana but more fields of potatoes and cereals. Five miles to the north the villages of S. Andrés and Los Sauces stand on either side of a deeply cut ravine, the slopes of which are very fertile and well cultivated, supporting a population of 4,600 inhabitants. The ravines increase in depth towards the north, and the villages decrease in size; Barlovento, the chief settlement of a district with 2,700 inhabitants, is itself little more than a hamlet.

The north-west of the island has about twenty deep barranco valleys scored in the sides of the Caldera. There are two small oases of settlement. The largest lies around Garafía, which is head of a wide district with 3,800 inhabitants. Farther south, separated from Garafía by the deepest ravines in the island, lies the village of Tijarafe, at the northern edge of El Time. The thatch-roofed houses have a poverty-stricken appearance, partly due to the isolation of this district.

Industries

A number of domestic industries still survive in La Palma and the people show much ingenuity in the manufacture of various articles either for their own use or for sale to visitors. The domestic spinning and weaving of local wool and silk is carried on especially in the north of the island, as well as the making of linen articles (from local flax), lace, and embroidered goods. The textile production includes the *mantas* or blanket cloaks of Garafía. Knives and tobacco pipes, highly carved or decorated, miniature water-barrels, brushes, and baskets are also made. The curing of tobacco and rolling of cigars are, however, the most important of these manufactures. Tobacco seed is imported from Havana and grown in La Palma, the leaf being made into a cigar which, if carefully rolled, is somewhat similar to those exported from Havana.

These domestic trades are a sideline of the agricultural peasants, agriculture being by far the leading occupation. The cultivated areas of La Palma lie mainly at heights of between 1,000 feet and 2,000 feet, and the chief district is in the west inland from Tazacorte, where plenty of water is available for irrigation. The leading commercial crops are bananas and tomatoes, which come especially from the rich valley-soils between El Paso, Los Llanos, and Tazacorte. The main cereals are rye, barley, and maize, the first being predominant in the less fertile northern districts. The common fruit-trees include the fig, orange, citron, almond, and quince, while onions, sugar-cane, and beans are commonly grown. The vine flourishes and is important near Mazo and on the volcanic slopes near Fuencaliente, where the best wine of the island is produced.

During the last fifty years the number of stock, other than goats, has decreased to a few thousand head of cows and sheep, the latter being a native black-woolled variety. Goats, however, have greatly increased and now outnumber all other kinds of stock combined. At Garafía a local cheese is made from goats' milk.

In addition to agriculture and domestic industries, forestry and fishing employ a few people. The timber cutting is done on the western slopes of the main ridge a few miles north of Fuencaliente, where pine trunks are rolled to the shore and then usually floated to Puerto de Naos or to Puerto de Tazacorte. The fishing is centred on S. Cruz, where, in 1933, the fishing-fleet consisted of 9 motor-craft of 3 tons each, 1 sailing-vessel of 61 tons, and 300 rowing-boats.

Ports

From a commercial point of view La Palma is the third most important island of the Canaries. The bulk of its trade passes through the capital, S. Cruz, and most of the remainder through Puerto de Tazacorte. In addition, S. Andrés on the north-east coast has a small landing-place with a quay that is used by fruit steamers in good weather.

Puerto de Tazacorte serves the extensive irrigated lands about Argual and Los Llanos, to which it is connected by a motor-road. Much of the fruit (mainly bananas and tomatoes) is carried to the beach on the backs of camels. Since there is no harbour here, the inter-island steamers lie off shore and receive the fruit from boats or, during the long spells of rough weather, by means of a mechanically worked aerial cable stretching from the cliff. The usual anchorage, in 17 fathoms at about half a mile off the beach, is exposed to west



57. *Barranco de las Angustias, La Palma*



58. *Crater near S. Antonio, La Palma*



59. *Los Llanos, La Palma*



60. *S. Cruz de la Palma*

winds. Tazacorte preserves its trade as it is the only port on the west coast of La Palma. It should be regarded as a complement rather than a rival of S. Cruz, which has the only harbour in the island.

S. CRUZ DE LA PALMA. (Lat. $28^{\circ} 41' N.$, long. $17^{\circ} 45' W.$ Population 7,915 in 1930.)

The town of S. Cruz stands near the middle of the east coast on the northern end of a sandy bay. The houses, shaded by tall Canary pines, stretch in terraces from the beach up the steep slopes of an old crater (Monte Buenavista, 1,339 ft.) which affords shelter from southerly winds. The town is not lacking in architectural interest, there being much elaborate wood-carving on façades, as well as a sixteenth-century town hall and a parish church with a magnificent Renaissance portal. The built-up area, which includes two hospitals and a few hotels, is traversed by several gullies. The country inland is, as a rule, steep and in parts broken by cliffs, but the flatter areas are fertile and well supplied with water. The chief imports are machinery, textile fabrics, and wine, while the main exports are fruits, especially bananas and tomatoes, and tobacco.

The anchorage, considered one of the best in the Canaries, is in 10 fathoms about 300 yards from the beach; it affords shelter except during winds from an easterly quarter. The harbour itself is protected by a mole which projects southwards from the southern end of the town. This mole is about 1,400 feet long and 65 feet wide, and has a depth of 20 feet or more alongside part of its length. It is accessible for ships drawing up to 26 feet, but the depths on its inner side are said to range from 12 to 21 feet. The harbour provides good shelter except from south-easterly winds. In 1940 it possessed one crane, capable of lifting 50 tons, and a few lighters (Photo. 60).

S. Cruz is linked to Los Llanos by a motor-road. It is the centre of a telephone system serving the main towns and villages of the island, and the terminal (at Playa de Bajamar 1 mile to the south of the town) of submarine cables from Garachico in Tenerife. The distance by sea to S. Cruz de Tenerife is about 105 nautical miles.

Communications

The road system of La Palma is very far from complete, the greater part of the island being served only by tracks. The northern mountains have no motor-roads, and the depth of the ravines makes the tracks long and difficult. The central ranges of the Gran Caldera, the Cumbre Nueva, and the Cumbre Vieja are similarly isolated,

and guides are necessary on the higher paths; the track from S. Cruz across the Cumbre Nueva to El Paso was formerly the main east-west connexion of the island, but is now little used. The motor-road round the south of the island from S. Cruz to Los Llanos now carries the main traffic and is used by the local omnibuses. This with its short branches provides about 60 miles of motorable road. The lack of roads is partly compensated by the local steamers and other boats which visit the few anchorages around the coast (Fig. 28).

The S. Cruz-Los Llanos road on leaving the port of S. Cruz makes a steep winding climb up the valley of the barranco de Juan Mayor to Buenavista (4 miles) at 1,100 feet. A fairly level stretch then leads past the farms of the Breña villages to the junction with the lower road from S. Cruz, one mile north of Mazo. The lower route is 2 miles shorter than the other and was constructed later; it keeps close to the shore of Santa Cruz bay, utilizing a long tunnel through the cliffs before it ascends the cultivated hill-slopes to the road junction. Passing through the village of Mazo (11 miles), the main road enters an arid area of volcanic hills, crossing a defile through the Montaña de los Rios to Flores (16 miles). Thence the landscape improves, the pine-woods on the lava streams giving place to grass-covered hills and vineyards around Fuencaliente (20 miles).

From Fuencaliente the road turns northward, flanked by pine-woods, and climbs to 2,500 feet. A gradual descent across a volcanic desert leads through S. Nicolas de las Manchas (thirty miles), the only village in the area. From Tajuya (33 miles), where a branch-road leads to El Paso, the countryside becomes greener and more fertile and the farms increase in number, in the valley of the Tenizca barranco. The road follows the valley and then climbs to Los Llanos (35 miles).

Three branch-roads radiate from Los Llanos. One runs down to the village of Tazacorte, and thence to the beach, where the tomato and fruit crops await shipment in large warehouses (6 miles). A second follows up the barranco de los Llanos, through almond orchards and palm-trees, to the large village of El Paso at 2,000 feet (3 miles). The third is planned to reach Tenerro, 3,650 feet high, which is at the edge of the Gran Caldera. Beyond Los Llanos this road crosses the barranco de los Llanos and the deep valley of the Angustias barranco and thence makes a steep zigzag climb up the precipitous mountainside of El Time (Photo. 61).

The only other motor-road in La Palma runs north from S. Cruz to Puntallana (7 miles). It is proposed to continue this to Barlovento, but the ravines form a considerable engineering problem.

HIERRO

PHYSICAL GEOGRAPHY

Relief

The island of Hierro stretches at its maximum extent for $18\frac{1}{4}$ miles from north to south and 13 miles from east to west and covers an area of about 120 sq. miles. Its interior consists of a high tableland lying mainly at between 2,500 feet and 4,000 feet above sea-level (Fig. 29).

In the north the tableland covers the whole width of the island (about 6 miles) and rises, in the various eminences above its general level, to between 3,000 and 3,400 feet. Valverde, the capital, is 2 miles inland as the crow flies but stands at 1,750 feet above the coast.

In the central part of Hierro the high tableland narrows to less than 3 miles and is fringed by precipices or inland cliffs which overlook areas of lower relief. These adjacent basins slope fairly steeply to the sea, where they usually terminate in a line of coastal cliffs. By far the chief of them is the large semicircular El Golfo, which faces the north-western coast between Punta Dehesa and Punta Salmona.

In the south of Hierro the plateau assumes an almost east-to-west alinement and at the same time becomes higher and more barren. It culminates in the Alto de Mal Paso (*c.* 5,700 ft.) which borders on the steep precipices overlooking El Golfo. On the other side the tableland drops steeply to the tall cliffs of the southern coast.

Drainage and Water-supply

The six small barrancos in the north of Hierro and the four in the south very rarely contain flowing water. Throughout the island there are practically no springs and the people obtain supplies from the rain, which is conserved carefully in tanks. The only instances of available ground-water seem to be a spring (Fuente de Azofa) south of S. Andrés, and another, with medicinal qualities, close to the sea north-north-west of Sabinosa. The latter is drunk copiously and has acquired a considerable local reputation in cases of skin and other malignant diseases. It is possible that insufficient has been done to probe underground sources of supply in many parts of Hierro, since a well sunk at the western end of El Golfo in 1921 is said to have struck water at a few feet above sea-level.

Vegetation

Below 1,500 feet there is very little vegetation on Hierro, the greater part of the surface being a rugged, stony, arid expanse with widely scattered euphorbias and cochineal figs. The mountains, above 2,000 feet, are only partially wooded, and there is far less tree-growth than is to be found on the other islands of the western



FIG. 29. *Hierro*
Relief shown by form lines

Canaries, although in some places, and more particularly near El Golfo, there are a fair number of trees. On the northern and western sides of the Alto de Mal Paso there are some luxuriant patches of giant heather and laurel, while on other parts of the great crescent of cliffs facing El Golfo there are thin woods of laurel and pine. The scanty natural vegetation of Hierro is not much relieved by cultivated trees, the only important fruit-trees being the fig, almond, vine, and mulberry.

Coasts

The coasts of Hierro are steep and uninviting, and the island is probably the most inaccessible of the Canaries. There are no coastal villages, and Valverde, the small capital of the island, lies 2 miles

from the sea. The cliffs are normally between 650 and 820 feet high, and at the lowest point in the north-western bay of El Golfo they do not descend below 30 feet. The only large sandy beach is Las Playas in the east, and that is cut off from the interior by a high mountain rampart. The main anchorage off the island is on the north-east coast at Puerto del Hierro, which lies south of Punta Caleta. A second anchorage lies near the southern headland of Punta Restinga, in Puerto de Naos, with depths of 9 to 11 fathoms. A track leads up to the road at Pinar, about $4\frac{1}{2}$ miles distant. This anchorage is rarely used except by coastal steamers engaged in local trade. A third exposed anchorage, rarely used, stands off the west coast at Puerto de los Reyes.

HUMAN GEOGRAPHY

Distribution of Population

The total population of the island is 8,071, the inhabitants living in one town, Valverde, and about twelve hamlets. The density of population is low, particularly when compared with the central islands of the archipelago, there being only 74 people to the square mile (Fig. 29).

In marked contrast to the other Canary islands the settlements are placed away from the coast, and the capital Valverde lies about 2 miles inland. This small town, which is the centre of one of the two districts of the island with 5,033 inhabitants, lies at about 1,900 feet in an amphitheatre of hills. The whitewashed houses are scattered over a wide valley, which owing to the lack of trees suffers from constant strong winds. Fields of potatoes and poor pasture land surround the town.

The eastern and southern areas of the island have few and unimportant hamlets. On the road south from Valverde stands Tiñor at 2,950 feet, its twelve or fifteen houses surrounded by a few fields, and the larger village of S. Andrés, where cereals and potatoes are grown. The village of Pinar, with about 400 inhabitants, is the most southerly settlement in the island; its cottages, many of them built without mortar and with thatched roofs, lie on the foothills of the Alto de Mal Paso.

The settlements increase in number and size in the agricultural area of El Golfo in the north-west. This area is cut off from the rest of the island by a bow-shaped wall of mountains which curves round to the south and east, and rises in places to 4,900 feet. Most of the

available land in El Golfo is utilized, but a range of volcanic hills across the centre of the area breaks the continuity of settlement. The largest village in the east is Frontera, the head of the second district of the island, which extends over El Golfo and has 3,038 inhabitants. To the south-west of the village lies Las Lapas, a scattered hamlet, distinguished by its clock-tower, which is perched on a hill some distance away from the actual church. The other hamlets here are Los Corchos and Los Llanillos, both surrounded by productive vineyards. Sabinosa is the main village in the western part of El Golfo, and lies between two small volcanic cones, its houses roofed with thatch or palm-leaves.

Industries

Hierro is economically the least important of the main islands of the Canaries. The marked lack of water for irrigation purposes greatly restricts agriculture, which is practically the only occupation of the people. Many of the inhabitants own patches of land on the interior plateau, where they grow cereals and pasture their stock during one part of the year. After the cereal harvest they migrate with all their families and chattels to other residences in the vineyards of the El Golfo area.

The chief products of Hierro are figs and wine. The former are grown especially near Pinar and El Golfo. Since dried fig is a staple food of the inhabitants, the trees have become of great local importance. The fig-trees are many-stemmed and are encouraged to straggle over a large space of ground. When standing in the open, they are protected from goats by small circular walls. Trees of this nature may cover a circle 12 to 15 yards in diameter and, owing to the law of division of property after death, may be owned by a great many individuals, members of the same family. In the course of generations the holdings may be so split that several people may be part-owners of one branch. If that branch dies, they cease to have any interest in the tree. The figs are grown in the barranco bottoms and in other sheltered localities: they are of a delicious flavour, quite unrivalled in the Canaries.

The wine production comes mainly from the slopes facing El Golfo, where the wine is of a peculiar vinosity and can be kept without the addition of spirits. The annual output is said to be between 100,000 to 150,000 gallons, of which more than half is exported. Other fruits include the almond, pear, and chestnut. Hierro does not produce much wheat but obtains fairly good crops of oats, barley,

and maize. The low rainfall and lack of irrigation almost prohibit the cultivation of legumes, tomatoes, and onions, and even the potato barely meets the home demand.

Stock-rearing is of considerable relative importance as the high uplands provide pastures and rough forage for cattle, sheep, goats, and mules. In spite of difficulties of water-supply, there are several hundred head of sheep and mules, a few score of cows, and probably well over 1,000 goats on the island.

The people seem indifferent to the rich fisheries off the coast and do no more than catch sufficient for the local market. In the past only one or two fishing-boats have been engaged in this industry.

Ports

There are no ports in Hierro, the so-called *puertos* being mere anchorages. Two anchorages are available to local shipping, and both are exposed to south-easterly winds and can afford shelter to small ships only. The one, Puerto de Naos, is used by local coasters which deal with the exports of figs from the Pinar district; the other, Puerto del Hierro, is the main anchorage and only harbour of the island (Photo. 62).

Puerto del Hierro is situated on a small beach about $1\frac{1}{2}$ miles south of Punta Caleta. The beach is strewn with large yellowish boulders and is overlooked by high cliffs. A short mole has been built which can be used by small craft. The anchorage lies in 5 fathoms near the shore of the bay with 17 fathoms close outside it. The amount of trade handled is very small and there are no regular visits of fruit-steamers. The main exports are figs, wine, almonds, and goat-skins, while the chief imports are foodstuffs (especially cereals), manufactured articles, and building materials. Puerto del Hierro, which takes nearly all the imports of the island, is linked by a motor-road to Valverde (4 miles). Its only form of signal communication is a submarine cable to S. Sebastián, Gomera, which is 44 miles distant by sea.

Communications

The greater part of Hierro is served by mule-tracks or paths. It is thought, however, that the tracks from the coast to Valverde, and from Valverde west to Jinama, and south to Pinar, may be motorable, though undoubtedly the surfaces would be rough and gradients steep.

The most important and best constructed route is the short connexion from the landing-place at Puerto del Hierro to Valverde. It winds steeply up the cliffs behind the beach and climbs to about 1,750 feet in its 4-mile course to Valverde.

Of the connexions beyond Valverde, that to Jinama is of importance as it leads to the edge of the agricultural district of El Golfo. The route lies south to Tiñor and thence westwards to Jinama, where the road ends. A track continues from Jinama down the wall-like edge of the El Golfo depression to the village of Frontera. An alternative track from Valverde avoids this sharp descent by a circuitous route to the north through Mocanal, and thence round the coast to Frontera. Neither, however, is an easy route.

The other road, which is reported to be motorable, runs from Valverde to Tiñor, and across a plateau to the village of S. Andrés. It then gradually descends to its termination at Pinar; its course is continued by a track leading south to the coast at Puerto de Naos. Tracks also run from Pinar north-west, towards Sabinosa and the western edge of El Golfo.



61. *Road from Los Llanos to the Gran Caldera, La Palma*



62. *Puerto del Hierro*



63. *Volcanic cone near Tetir, Fuerteventura*



64. *Barranco de Gran Tarajal, Fuerteventura*

FUERTEVENTURA

PHYSICAL GEOGRAPHY

Relief

Fuerteventura lies about 45 miles north-east of Gran Canaria and 67 miles north-west of the African coast at Cape Juby. The second largest island of the Canaries, it has a maximum length of 63 miles, a maximum width of 21 miles, and an area of about 670 square miles. As regards scenery and climate it is the least mountainous and the most arid part of the Canarian archipelago, and might, in these respects, be considered as a detached fragment of the Sahara. The island as a whole is a low, undulating plateau, surmounted by numerous volcanic hills, which are not arranged in any definite orographic system (Fig. 30).

The northern part of Fuerteventura consists of extensive plains which are interrupted in the centre and the west respectively by two small, rounded blocks of hills (880 ft.). On the north-east, especially near the coast, the sand has been blown into dunes, but elsewhere a stony surface predominates. The group of barren hills inland of Tostón bears evidence of a former surface drainage in a ramification of dry runnels which unite to form barrancos that are often 20 feet wide and 9 feet deep, with absolutely perpendicular sides.

Between the latitudes of Oliva and Puerto de Cabras the uplands occupy the centre of the island and rise to just over 2,200 feet in Montaña de la Muda and in the hills near Tefia. The main groups of hills are, however, far from continuous and in parts recede to leave between them large depressions, the chief of which adjoins Oliva. The coastal areas maintain an even or undulating relief except where broken in the east by two large spurs, the one stretching from Montaña la Atalaya (1,700 ft.) to Montaña Roja (1,000 ft.) near the headland of that name, and the other from Tefia to the neighbourhood of Puerto de Cabras (Photo. 63).

South of Puerto de Cabras the main volcanic groups tend to divide into an eastern and western range that encircle a central plain. The eastern range, largely an alinement of rounded, isolated hills, rises to between 1,600 feet and 1,800 feet at several points. It keeps for much of its course close to the sea but does not seriously impede communications since the only good road inland follows the wide valley of the Gran Tarajal. The western line of hills lies usually at 2 to 4 miles from the coast (2,000 ft. north of Betancuria), the intervening



FIG. 30. *Fuerteventura*
Relief shown by form lines

slopes being gentle enough to be termed *llanos*. These two peripheral uplands unite in the south at Montaña del Cardón (over 2,200 ft.), an arc of barren volcanic hills that drops steeply southwards to the low isthmus of La Pared. The extensive depression forming the central belt of Fuerteventura consists of vast sandy or stony plains, divided by low hills and isolated volcanic groups into a series of flat subsidiary basins, the general altitude of which ranges from 850 feet to 1,200 feet in the north and 600 feet to 800 feet in the south.

Fuerteventura terminates south-westwards in the mountainous peninsula of Jandía and the sandy isthmus, about 7 miles long and $2\frac{3}{4}$ miles wide, that links it to the main part of the island. The latter is so low that from a distance the Jandía mountains appear to be a separate islet. This neck is covered with a layer of sand, fashioned by the wind into small, shifting dunes of a light colour which resemble low, whitish bushes; hence the name Las Matas Blancas.

The alternative name of Ismo de La Pared (Spanish, wall) arises from the defensive wall that formerly separated the territory of the chief in the peninsula from that of his rival in the main part of the island. The isthmus grades southwards into the volcanic ridges of Jandía, the most rugged and mountainous part of Fuerteventura. This ridge extends for a length of 12 miles and rises to 2,750 feet in the Orejas de Asno (Ass's Ears). On the north side the mountains drop precipitously to the coast, which is flat and sandy in the parts nearest to La Pared and increasingly abrupt towards the narrow termination of the peninsula; on the south the descent is more gradual and ends in an alternation of long sandy beaches and stretches of cliff. The rugged, mountainous nature of Jandía does not relieve its aridity, and its volcanic slopes, like the sands at their foot, are almost completely barren.

Drainage and Water-supply

In Fuerteventura there is less water and less verdure than in any other of the main islands of the Canaries. Only eight barrancos reach a significant size, and even these have wide shallow valleys. Of the four chief barrancos on the west, the barranco de Rio Palmo alone is important since it carries, for much of its course, a permanent stream that feeds a fast-flowing acequia. It may be that the volume of this rivulet was once greater, as near the hamlet of Rio Palmo there are traces of an old dam with a tower which once housed a mill driven by the stream. On the east the barrancos de Gran Tarajal, de la Torre, de Muley, and Diamante stretch from the central plains to the coast. It is not uncommon for a small stream to be flowing in the upper course of the barranco Diamante, but the other watercourses are usually dry for long periods. The bed of the barranco de Gran Tarajal is usually dry, but contains enough ground-water to support a thick gallery of tamarisks. A sudden rainstorm, typical of the rare rains of Fuerteventura, will in a few minutes transform this streamless valley into a raging torrent of dirty yellowish water and pebbles which discolours the sea for a mile or so off shore.

These heavy rains occur at long intervals, yet the floods accompanying them necessitate the construction of numerous paved splashes on the few motorable roads in the island. Among the few other places where running-water may be seen are at an acequia, used for sanitation, from the Río de Cabras to Puerto de Cabras and in the watercourses used for irrigation in the Valle de Ortega between Antigua and Agua de Bueyes.

Fuerteventura has very few fresh-water springs, almost all the existing sources being in the south of the main body of the island, where they occur, for example, near Betancuria and near Chilegua at the base of the barren Montaña del Cardón. Drinking-water is scarce, occasionally disagreeable to the taste, and often only obtainable by purchase. Consequently, rainfall is collected with the greatest of care, the methods varying from the small receptacles placed on top of stone pillars at Puerto de Lajas to the open yards between each house at Oliva. Puerto de Cabras stores its drinking-water in sealed, underground tanks, but the rain-water has to be supplemented by wells. In the southern parts of Fuerteventura supplies obtained from borings may be palatable, as happens near Tuineje and Tiscamanita, where wells 25 feet to 35 feet deep strike good drinking-water. The floors of the barrancos, as near Toto, are also suitable sites for borings. In times of protracted drought, these sources of drinking-water become hopelessly inadequate and the people then are entirely dependent on water-boats from Las Palmas.

The various borings which provide the bulk of the island's water-supply depend for their success on the limestone beds that extend, either continuously or as scattered veins, throughout the central plains. The original source is probably rain which sank through the sands and limestones and accumulated above the underlying igneous floor, especially in its undulations. The traverse of the beds of gypsum makes some of the water brackish, while in places the lime content is unpleasantly high. The fact remains, however, that water suitable for farming purposes can usually be found on the main part of the island by sinking wells to a depth of 35 feet to 65 feet. These wells, and the windmills to raise the water, abound in parts of the flat, central plain stretching from near Ampugenta in the north to beyond Florida in the south. Borings have been made over a much greater area than this, sometimes with success and sometimes with poor or doubtful results, due no doubt in some instances to shafts not being driven as deep as the aquifer.

In recent years the number of pumping-mills has increased to 400,

whereas in May 1930, after nearly 7 years of drought, only about 20 were working, the rest having been rendered more or less useless by the sinking of the water-table. In addition, there are 400 well-borings where water has been found but, owing in most cases to lack of capital, no pumping system has been installed. Since the average depth of the wells is 50 to 60 feet, deepening to 100 feet or 150 feet might ensure a more reliable supply. The nature and extent of these underground supplies are not known with sufficient accuracy for a judgement to be passed on their reliability and permanence. Yet the catchment areas are rather small, and it seems that although deep borings will be successful for some time to come, the sources will ultimately decline and once the accumulation of centuries is exhausted the rains will be quite inadequate to recompense the pumpings. Then the wholesale emigration or almost complete abandonment of the island, resorted to in some years previous to the extensive sinking of wells, may be expected to recur in times of prolonged drought.

Vegetation

Apart from the cultivated areas near the villages and on the beds of the better-watered barrancos, Fuerteventura is mainly desert or semi-desert. There are no forests and very few trees, the former palm-groves having been most effectively cleared during the last five centuries of Spanish occupation. The tree-growth consists chiefly of scattered fruit-trees in the irrigated districts and of palms near the valley-bottoms and wells. A few of the barrancos may support patches of tamarisk, while in the north the ice-plant is still fairly common. Considerable areas are desert with nothing more than a few microscopic plants, but much of the island carries a thin covering of plants, such as *Sonchus* and *Euphorbia*, which afford a poor type of grazing for camels and goats.

Coasts

The island of Fuerteventura has a comparatively regular outline except for the considerable peninsula of Jandía in the south-west. Though much of the coast is cliffed, there is a larger proportion of long sandy beaches here than is usual in the other Canary islands. The chief port is Puerto de Cabras, on the east coast, but landing is possible at other coves, particularly at Gran Tarajal.

The east coast (roughly 39 miles long) stretches from Punta Gorda to Punta Jurada, and runs almost due north-south. To the north of Puerto de Cabras the coast is mainly flat and sandy, and is the seaward

edge of a barren plain which stretches inland to a low border of bare hills. One fishing-hamlet, Puerto de Lajas, lies 4 miles north of Puerto de Cabras and has a wide sandy beach, exposed to continual surf. Tracks run inland from the hamlet to join the Puerto de Cabras-Oliva track. The bay of Cabras affords fairly adequate shelter for local traffic and a stone mole has been built from its northern end. The group of white houses which forms the small capital of Puerto de Cabras stands on the slopes of a treeless hill; roads lead thence to Oliva and Antigua. Low sandstone cliffs which extend south of the town have been eroded into innumerable small hollows and caves. There are no coastal tracks or settlements to Punta Jurada.

The south coast from Punta Jurada to Puerto Pared has almost continuous sandy beaches, behind which rise low rugged hills, cultivated only up the few barranco valleys. There are small fishing-villages along this coast. The most important is Gran Tarajal, a village occupying a sandy cove, about half a mile long, at the outlet of the barranco de Gran Tarajal (Photo. 64). The local products are exported here, and there is an inferior road connexion through Tuineje with Puerto de Cabras. Other anchorages which are seldom used lie off Puerto Tarajalejo and Puerto Pared.

The shores of the Jandía isthmus are formed of fine white sand, which in places forms low dunes. As there are practically no permanent inhabitants, the beaches, often covered by heavy surf, are, in fact, little used.

Beyond the Ismo de la Pared the western coast has a north-easterly trend to Punta de Tostón. The low cliffs are almost unbroken, but landing is possible at two points. The southern is the Puerto de la Peña, a beach at the mouth of the largest valley on the island, that of the Rio Palmo. Heavy surf often makes landing difficult on the beach, and a cliff-bound cove to the north, honeycombed with caves, is then used by local fishermen. Rough tracks lead from the shore to Pajara and Betancuria. The northern landing-place is at Tostón cove, where a wide sandy beach extends to the south of the dangerous basaltic reefs which lie three-quarters of a mile off Tostón promontory. The hamlet of Tostón lies a short distance inland and is very remote from the other centres of the island.

The coast from Punta de Tostón to Punta Gorda forms the southern shore of the Estrecho de Bocaina but is inaccessible because the cliffs, though fairly low, are continuous. The small island of Lobos lies about $1\frac{1}{4}$ miles from Punta de Corralejo; the strait separating it from Fuerteventura is liable to heavy swell.

HUMAN GEOGRAPHY

Distribution of Population

Fuerteventura has a total population of 13,629 inhabitants, and as it is the second largest island in the Canaries, the density of population is very low, there being only about 20 persons to the square mile. The influence of the Sahara desert is more marked here than in any other island of the archipelago, because it lies nearest to the African coast. In particular, the location of settlement in Fuerteventura is influenced by the position of wells or springs to an even greater extent than in the other Canary islands. The settlements therefore tend to be small and isolated and, where water for irrigation can be obtained, they are surrounded by small patches of productive land (Fig. 30).

There are slight variations in the distribution of population between the north, centre, and south-west parts of the island; the north is mainly desert country with few settlements; the centre or south has a somewhat better water-supply, and consequently more villages; and the south-western peninsula of Jandía is practically uninhabited. The northern region extends roughly north of Puerto de Cabras, the port and capital of the island, which is described on pp. 201-202. The greater part is characterized by extreme aridity, a few fields of barley, a small herd of goats, and one or two mean habitations being the main signs of human occupation. The village of Tetir, however, occupies a more favourable position in a fertile valley. Oliva, the centre for the northern district with 2,300 inhabitants, lies at about 1,700 feet in a depression between the Montaña de Oliva on the west and the Montaña la Atalaya on the east. Here, as in many other settlements of the island, the houses which compose the village are very widely scattered.

The central region is less arid than the north and has several large villages, including Casillas del Angel, Antigua, Betancuria, Pajara, and Tuineje. Antigua, head of a district with 1,670 inhabitants, occupies one of the more favoured areas on the barranco de la Torre. About $5\frac{1}{2}$ miles to the west, separated from Antigua by the steep-sided ranges of Montaña la Villa, lies Betancuria, at about 1,150 feet in a mountain-encircled valley. Founded originally by Bethencourt as the capital of the island (a position it later lost because of its isolation), Betancuria is now little more than a village, its district having only about 650 inhabitants. The neighbouring village of Pajara also suffers from its isolated position, the only outlet being from the exposed

anchorage at Puerto de la Peña. It stands in the valley of the Rio Palmo barranco and commands the largest district of Fuerteventura. This includes the Jandía peninsula, and despite its large area has only 1,300 inhabitants. A stretch of comparatively densely peopled country extends south from Antigua to Tuineje, some of the slopes being particularly fertile. Tuineje, the head of the southern district with 2,400 people, has the advantage of direct road communication with the small port of Gran Tarajal. The small village of Chilegua is peopled by a few shepherds who utilize the scanty pastures of the region and rear goats and camels.

Much of the Jandía peninsula is complete desert and is composed of arid sand-dunes and low volcanic hills.

Industries

Fuerteventura supplies most of the other islands of the archipelago with limestone and plaster (*yeso*), for which quarries are worked near Tostón, Antigua, and Puerto de Cabras. Small industries also exist in the evaporation of sea-water for salt and in fishing, a fish-cannery having been recently erected near Puerto de la Cruz. These occupations, however, are insignificant compared with those of an agricultural nature.

Agriculture in Fuerteventura is almost entirely controlled by the available water-supply, and the farm lands may be divided into three groups, those which can be irrigated, those dependent on dry-farming, and those which are too arid for cultivation.

A few of the irrigated areas obtain water from springs and streams as in the Rio Palmo valley, but most of the irrigation water is obtained from well-borings. In these districts the farms are small and cultivation is not extensive. By far the chief crops are tomatoes and alfalfa, but the banana, date-palm, orange, pomegranate, fig, carob, lentil, onion, maize, and potato are also grown to a lesser extent. The main areas of irrigated crops are near Pajara, Valle de Rio Palmo, Oliva, and Gran Tajaral.

The dry-farming districts are much larger than those under irrigation. The chief method used is the spreading on the surface of the ground of a smooth layer of black volcanic ashes which rapidly absorbs any rainfall and minimizes the loss of water by evaporation. The layer varies in thickness from $2\frac{1}{2}$ to 5 inches according to crop and exposure. In sowing, a spade is used, a furrow being carefully made in the layer of ashes, and then, after sowing, being covered up before the next furrow is cut. These ash-covered areas produce

maize, the cochineal cactus (*Opuntia*), potatoes, chick-peas, onions, wheat, barley, and sisal hemp. The cochineal cactus yields well and, besides acting as the host of the cochineal bug, supplies leaves for fodder and fruits for the people. The cereal crops are sown very thinly and the plants, especially of maize, are small. The crops vary greatly with the amount of rainfall. Thus the wheat harvest after several dry seasons will not suffice for local needs, while in a 'rainy' year it may exceed the production of all the other islands of the Canaries combined. The largest districts of dry-farming are the undulating basins near Oliva and in the centre of the island between Casillas del Angel and Florida.

Areas which are too arid for cultivation cover the main part of Fuerteventura. These lands are either completely useless or afford rough grazing for goats, sheep, camels, and cattle. Camel-breeding is important, but the goat is the mainstay of the pastoral industry and during the present century the number of goats has reached 20,000 or about four times the number of camels on the island.

Ports

All the so-called ports of Fuerteventura are mere anchorages except Puerto de Cabras, the capital and chief port. On the west coast Puerto de Tostón, the outlet for Oliva, and Puerto de la Peña, the outlet for limestone from the Pajara area, are rarely visited except by small local boats or by a few sailing-vessels in summer. On the south-east coast the Puerto de Gran Tarajal is visited by inter-island steamers and by fruit boats on the way to Puerto de Cabras. The small bay here is well sheltered except with winds from east through south to south-west. A small pier has been built, but all cargo is transhipped by surf boats and passengers are carried by waders through the surf. Hence it happens that only Puerto de Cabras has accommodation for inter-island steamers and alone deserves the title of port.

PUERTO DE CABRAS (Lat. $28^{\circ} 29' N.$, long. $13^{\circ} 51' W.$ Population of district 3,441 in 1930).

Puerto de Cabras is built on the slopes of a hill which descends gradually to the shore. Although the capital of Fuerteventura, the town consists only of a few hundred, square, white houses arranged about a few straight, wide streets, for the most part either cobbled or unpaved. The buildings include a post office (with telegraph), a

customs house, a church, and an hotel. The surrounding country is mainly semi-desert, but a fairly adequate supply of drinking-water is obtained from the storage of rain-water and from wells.

The town stands on the north-western shore of a bay, the only important inlet on the east coast of the island. This bay affords an anchorage in from 4 to 7 fathoms over a sandy bottom at a few hundred yards off shore; it is well sheltered from winds from south-west through west to north, but is exposed to those from east and north-east. The shores of the bay are rocky except for a small stretch of sandy beach eastward of the port and for a much wider beach one mile to the south.

Puerto de Cabras has a stone pier which projects about 100 yards into the sea from the eastern end of the town, thereby giving additional shelter to a creek 40 yards wide by 50 yards long into which small vessels can enter. Inter-island steamers berth alongside the pier or anchor in the roadstead just off the port. The amount of trade done is small, the main imports being manufactured goods, timber, and preserves, and the chief exports cereals (in good years), limestone, plaster, tomatoes, chick-peas, and cochineal.

The main occupation of the townsfolk is fishing. Two main roads lead inland, the one north-westwards to Oliva and the other south-westwards to Casillas del Angel and Tuineje. Submarine cables link the port to Las Palmas (103 nautical miles) and to Arrecife in Lanzarote (35 nautical miles).

Communications

Fuerteventura has two motorable roads, both of which lead from Puerto de Cabras, one north to Oliva, the other south to Gran Tarajal. The rest of the settlements are connected by tracks, not kept in repair and often in poor condition. Communication throughout the island is, however, greatly assisted by the flatness and barrenness of much of the countryside, and the main physical obstacles to transport are the few dry but steep-sided barrancos. There is a great contrast between these level tracks over empty desert-like plains of volcanic sand and rock, and the motor roads of northern Tenerife or Gran Canaria winding across cultivated densely-peopled mountain sides. Local transport is done by camel rather than by mule or motor-lorry. The camel is well adapted to such climatic conditions and to the sparsity of pasturage in the island, providing a cheap, reliable form of transport between villages spaced far apart (Fig. 30).

The road from Puerto de Cabras to Oliva is circuitous. It runs

westwards up a gentle slope for $5\frac{1}{2}$ miles to Tetir. Beyond this village it crosses a spur of the mountains near Tefia, and descends to the hamlet of La Matilla ($7\frac{1}{2}$ miles). A circuitous route from La Matilla bears west across the Montaña de la Muda to Tindaya, where a track diverges to the hamlet of Tostón, and thence the road runs east to Oliva ($14\frac{1}{2}$ miles). Oliva is the centre for the tracks of the north and has a direct connexion with Tostón and with Corralejo, a fishing-hamlet facing the island of Lobos. There is also a track to Puerto de Cabras, which uses a shorter route than that taken by the road.

The road to the south has a fairly good surface, broken at short intervals by water-splashes. These appear unnecessary in so dry an island, but they are designed to carry off the occasional heavy rains, which for a few days may make the routes impassable. From Puerto de Cabras this road runs westward and climbs gradually to the cultivated country around Casillas del Angel ($7\frac{1}{2}$ miles). Thence the route lies to the south, and the road, crossing a rather barren range of hills, descends into the plain around Antigua (14 miles). Several tracks lead from here, the most important being that running westwards to Betancuria. From Antigua the road runs across cultivated fields through Agua de Bueyes to Tuineje (21 miles). A branch road runs westwards from this village to Pajara, and there are several tracks to the south-west and the fringes of the Jandía peninsula. From Tuineje the road takes a southerly course and passes through a region of moderate cultivation, descending the barranco de Gran Tarajal to Puerto de Gran Tarajal ($30\frac{1}{2}$ miles).

ISLA DE LOBOS

LOBOS lies about $1\frac{3}{4}$ miles from Punta de Corralejo in north-eastern Fuerteventura and just over $5\frac{1}{4}$ miles from Punta de Papagayo (Papapagallo), the southern extremity of Lanzarote (Fig. 30). The island stretches for 2 miles from north to south and $1\frac{1}{2}$ miles from east to west, and nowhere exceeds 360 feet in height. The main topographic features are a hill in the south and a number of conical hillocks, 100 feet to 200 feet high, scattered over the other parts of the island.

Nearly all the coast is rocky, fringed with boulders, and very indented. Landings may be made at a sandy beach on the south-east coast and in the Caleta del Palo on the south-west. The Caleta, a circular cove with steep shores formed by the partial inundation of the volcanic crater, does not afford such easy ingress as the landing-beach. The channel between Lobos and Fuerteventura deepens to

a fairway with a minimum depth of 5 fathoms. On the north side of Lobos a reef extends about 600 yards off shore from Punta Martino, where a lighthouse has been built on a conical hillock about 75 feet high.

This lighthouse is the only reason for the habitation of Lobos, there being in 1937 only 12 people living on the island. Lobos is barren and springless, but the surrounding seas abound in numerous species of fish which, together with the colonies of shearwaters, attract a few fishers from Lanzarote and Fuerteventura. The catching of seals (*lobos marinos*), from which the island derived its name, ceased long ago, as the animals no longer visit its coasts.

LANZAROTE

PHYSICAL GEOGRAPHY

Relief

The island of Lanzarote has a maximum length of $36\frac{1}{2}$ miles, a maximum width of $13\frac{1}{4}$ miles, and an area of approximately 280 sq. miles. Although less mountainous than the islands of the western Canaries, it has a very accidented relief, and its culminating height of 2,247 feet gives little idea of the irregularity of its surface. The great mass of basalt composing its base is dotted with craters and ribbed with lava-flows, which furnish abundant evidence of violent vulcanism. Upon this volcanic complex the aridity of the island has imposed a covering of sand which forms the surface of much of the lower areas and not infrequently becomes moving dunes. As a result of the aridity there are few true barrancos or other scenic features associated with the work of running water (Fig. 31).

Lanzarote north of Tegüise is little more than a peninsula of the main mass of the island, the width from shore to shore narrowing here to between 4 and 6 miles. The dominant feature of the relief is the Risco de Famara, a north-to-south alined ridge closely resembling the surviving fragment of the rim of a large crater. The Risco rises in the south to 2,247 feet, the highest part of Lanzarote, and declines northwards to about 1,575 feet at Montaña Orsula. On its western side the ridge drops precipitously for 1,000 to 1,400 feet, falling in some parts sheer to the sea and in others to a narrow coastal platform; on the east the slope is more gradual and merges into a coastal plain that extends for $1\frac{1}{2}$ to 2 miles between the 300-foot contour and the sea-cliffs. The regularity of the descent on the eastern side is broken by isolated craters, such as Montaña Corona (c. 2,900 ft.), so that when seen from the summit of the Risco the area resembles 'a patch of sand upon which children have made a number of mounds with their buckets'. The chief habitable areas are the two valleys lying at nearly 1,000 feet about a mile east of the main range near Haría. These valleys lack the incised nature of the barrancos of the western Canaries and are nothing more than wide, shallow depressions.

The southern end of the Risco de Famara overlooks an extensive plain that stretches, with a varying width of 5 to 8 miles, to the volcanic highlands near S. Bartolomé and extends 12 miles from coast to coast. Much of this region is a desert of sand, with crescentic dunes which arise on the eastern beach and move over the island



under the influence of the prevailing winds. The land near the coasts is under 300 feet in altitude, and even in the centre of the island in the low flat saddle between Teguisse and S. Bartolomé (5 miles) scarcely exceeds 800 feet. The general flatness is interrupted by isolated volcanic craters, but the sand has obliterated the minor irregularities and there are no traces of the work of running-water.

South of the road from Tinajo to Arrecife, Lanzarote consists mainly of a tableland at an altitude of 1,000 feet to 1,400 feet. Above the surface of this plateau rise numerous volcanic peaks that tend to form a short range running southwards from the neighbourhood of Tiagua, and a much longer chain stretching from S. Bartolomé south-westwards to La Breña. The latter range is composed of more or less isolated peaks that rise to about 1,900 feet west of Goime and exceeding 1,650 feet at several other places; near Uga the ridge narrows to a low col (*c.* 750 ft.), beyond which it rises steeply to Montaña Atalaya (*c.* 2,000 ft.; north-west of Femés) and Montaña Hacha Grande (*c.* 1,800 ft.). Most of these and the other volcanic craters in Lanzarote are barren and stand out clearly from the sandy plains and stony, undulating depressions surrounding them.

On the south-east the tableland falls regularly to a coastal platform, which is floored locally with disintegrated fragments of lava, whereas on the north-west the general declivity is interrupted by a volcanic ridge, the Montañas del Fuego, that is distinctly mountainous in spite of a summit height of only 1,480 feet. Much of this ridge is of recent origin and overlooks on the north a wide expanse of lava and scoria so little weathered as to be almost uncrossable. The Montañas del Fuego were active in 1733, and many of their crevices and blow-holes retain enough heat to kindle wood and to boil water. Another notable result of recent eruptions in this part of Lanzarote is the great lava-flow, a mile-wide, chaotic accumulation of rough, sharp lava-blocks, stretching from Uga to the sea north of the Lago de Janubio. The coastal areas on the extreme west and south-west of the island are low, flat, waterless platforms of sand and lava, rarely interrupted by minor volcanic cones and almost always terminating in precipitous cliffs.

Drainage and Water-supply

Streams are rare in Lanzarote, the few barrancos of the east coast being nearly always dry. Almost all the central and western parts of the island bear no traces of the work of flowing water, which is never seen except on the flanks of the escarpment north of Teguisse where,

after abnormal rains, rivulets may trickle for a few hundred yards before disappearing into the sands. On the east side of the island, between Haría and Tahiche, there are nine small watercourses, but these very rarely contain streams in any part of their length and their valleys are not deeply incised.

The Teguisse-S. Bartolomé plain and the main mass of Lanzarote south of it have no surface drainage, the only traces of the work of running water here being the insignificant barrancos, usually dry, east of Tias and Femés. The Lago de Janubio in the south-west is a salt lake, lying in a perfectly flat basin, surrounded on three sides by a low, elevated plateau and on the north by a large lava-flow.

A few springs are to be found in Lanzarote, but only one (on the Risco de Famara) is permanent and even that is not strong. Since borings have either proved abortive or have yielded brackish supplies, the island depends almost entirely on rainfall. Rain-water is carefully collected and stored in tanks and reservoirs, such as occur, for example, west of Arrecife and near Teguisse and Haría. For the needs of crops, bare plains are levelled and sloped so as to drain into a cistern which is covered to minimize loss by evaporation. Frequently, too, near a farm-house, a large space levelled and sloped in this way towards a cistern is covered with a layer of trampled, volcanic tuff; this space is surrounded by low walls and serves in winter as a means of accumulating water and in summer as a threshing-yard. In spite of these efforts, supplies for drinking and agriculture are never plentiful, and after prolonged drought (as happened between 1923 and 1930) water has to be shipped from Gran Canaria and Tenerife. Most of the rain falls in winter, when during a favourable season a useful quantity of water may accumulate above the igneous sub-strata; sufficient has fallen, for example, to flood low-lying parts of the Arrecife-Tahiche road to a depth of several feet. The island, however, in normal years can barely provide the needs of its inhabitants.

Vegetation

The former forests of Lanzarote have disappeared entirely and large areas, especially of recent lava-flows, have no vestige of plant life or merely support widely scattered and stunted euphorbias. Only on the high slopes of the Risco de Famara near Haría are shrubs common and the landscape green. The tamarisk is planted near some of the roads where conditions permit.

Coasts

Almost continuous rocky reefs and cliffs make the island of Lanzarote difficult to approach. From the north-eastern point of Fariones to Arrecife, a distance of about 25 miles, there are low cliffs with rocks lying off shore making landing almost impossible. A small jetty, however, has been built in the bay at Arrieta, and is joined by road to Haría and Arrecife. About three-quarters of a mile north of Arrecife lies Puerto de Naos, a small enclosed harbour formed by Islote Cruces, Islote Francés, and an abrupt bend in the coastline. The port of Arrecife lies just to the south between the Islote de San Gabriel, which has been extended by a breakwater, and several small islets (Fig. 32).

South of Arrecife the coastline at first trends westwards and thence south-westwards to Punta de Papagayo. The coast as a whole is rocky, and is formed in places by black basaltic lava-flows, which give an increasingly desolate and empty appearance to the interior. There is one landing-place at the beach of La Tiñosa, occupying a break in the rugged headlands. This hamlet is visited by the local steamers, which collect the onion crop for export (Photo. 65).

Between the two promontories of Papagayo and Pechiguera the south-west coast forms the rocky shore of the Estrecho de la Bocaina, the strait which separates Lanzarote from the islands of Fuerteventura and Lobos. There are no anchorages here, though the strait is easily navigable by all vessels.

The 30-mile stretch of the western coast from Punta Pechiguera to Punta de Penedo has high cliffs, with jagged reefs lying off shore which are dangerous to shipping. Inland stretches arid and uncultivated volcanic country, with the small Lago de Janubio separated from the sea by a narrow lava ridge. An islet, the Isla del Rio, lies close to the coast just south of Punta Pueto, and some salt-pans have been made here. There is an anchorage which is very seldom used in the shelter of Punta de Penedo where a wide bay opens out bordered by sandy beaches. A track leads from the shore to Teguisse.

North of the Playa de Famara a steep-sided range of volcanic mountains, the Risco de Famara, descends sheer to the sea. This forms the southern shore of the Estrecho del Rio which separates Lanzarote from Graciosa. Secure from winds in all directions, and with good depths, the strait provides some of the safest anchorages in the Canaries. It is, however, rarely used owing to the lack of water and provisions, the remoteness from the populated parts of the island, and the absence of overland communications.

HUMAN GEOGRAPHY

Distribution of Population

In 1930 Lanzarote had 25,325 inhabitants, so that the density of population was about 90 people to the square mile. This compares favourably with the density of population in Fuerteventura, but the sandy arid countryside cannot support the dense settlement which is characteristic of parts of Gran Canaria and Tenerife. The earliest of the European settlements in the archipelago was founded at Fort Rubicón in the south-west of Lanzarote which is now one of the most barren and desolate parts of the island. Its easterly position near the African coast made Lanzarote particularly open to raids from the Moors and many of the villages were placed inland, including the former capital of the island, Teguiise (Fig. 31).

The southern part of the island is, on the whole, arid and thinly peopled, there being practically no settlement in the Montañas del Fuego area. The larger villages lie from 3 to 5 miles inland and usually consist of a loosely grouped collection of farms and cottages placed where the water-supply is comparatively good. Tias, a large village which is the centre for a district with 2,500 inhabitants, is scattered over a wide area to the north of the Arrecife-Yaiza road. A cultivated plain extends west of Tias dotted with several farms and hamlets to the village of Yaiza. In the extreme south of the island, Femés is the head of an arid district with 498 inhabitants, most of whom live in Femés itself or the nearby hamlet of La Breña, or on the shores of the salt lake of Janubio.

The centre of Lanzarote contains several of the larger settlements of the island, including the capital and port of Arrecife. The hinterland of Arrecife is composed of arid wastes of lava and volcanic sand, with occasional small fields planted with wheat or barley and a few shrubs. A low range of volcanic hills stretching across the island to the west of Arrecife affords sites for several villages, including two district centres, S. Bartolomé and Tinajo. A second group of settlements lie on the hills to the east, leaving a corridor of desert country behind Arrecife which extends almost to the north coast. Teguiise is one of the largest of the eastern settlements and stands on a plateau about 900 feet high, its old seignorial houses and church giving evidence of its former importance as the capital of the island. This small town is the centre of a district with about 5,500 inhabitants. Tahiche lies to the west of a volcanic cone at the meeting-place of two roads from Haría. Many of the houses, which are spread far



65. *Coast of Lanzarote at La Tiñosa*



66. *Vines planted in volcanic cinders, Lanzarote*



67. *Camel hauling volcanic cinders in saddle-box, Lanzarote*



68. *Puerto de Arrecife, Lanzarote*

apart, are sturdily built, with outhouses and stables constructed of stone, which is particularly plentiful here. Formerly some of the inhabitants used to live in houses, like those of the Guanches, which were partly sunk below the level of the ground. Teseguite, El Mojon, and Guatiza are other villages in this region and are typical of Lanzarote in the wide spacing of their farms.

In the north the oasis of cultivation surrounding Haría is probably the most densely peopled area in Lanzarote. The town of Haría, which with its district has over 3,500 people, is situated in the valley of Temisa surrounded by the Risco de Famara on the west and by other volcanic hills to the south and east. The valleys are well cultivated, and houses, spaced far apart, are usually enclosed by gardens. The arid hills of the northern point of the island are sparsely peopled.

Industries

Most of the inhabitants of Lanzarote obtain a living from either agriculture or fishing. A greater proportion of the island is under cultivation than in Fuerteventura, although well-borings are rare and the rainfall is very unreliable.

Normally Lanzarote produces a fair quantity of cereals, including barley, maize (of a dwarf variety), and some wheat. These crops mature rapidly and are harvested in April or May. The barley is sown in rows, the seeds being planted in small heaps of four or five grains so that the heads will grow in clusters and support each other.

A good white wine is produced, from 80,000 to 100,000 gallons being exported in most years, as well as a muscatel grape of a superior quality. The best wines come from the neighbourhood of the Montañas del Fuego, where the vines are planted in separate holes excavated in the lava so as to expose the soil beneath. This method also allows the roots to reach any available underground moisture and protects the plants from dry winds. In exposed areas a wall of stones may be piled in front of the hollows as a further protection against the wind. It is not unusual for a well-matured vine grown in such a hollow to yield over 100 gallons of wine during the vintage (mid-August). Often mulberries are also planted in a similar way.

Other crops include chick-peas, potatoes, onions, melons, tomatoes, and tobacco. The methods closely resemble those practised in the non-irrigated parts of Fuerteventura, the soil being covered with a few inches of volcanic cinders which need renewing every three or

four years. One or two heavy showers in a year will yield sufficient moisture for two seasons' crops. Where well-borings near the coast have yielded saline water, alfalfa is nearly always the main crop. The most fertile areas of Lanzarote are the depression near Uga (maize, wheat, vines, figs, and palms) and the undulating plateau near Haría where figs, mulberries, palms, cactus, the usual cereals and vegetables grow well (Photos. 66 and 67).

Lanzarote has little pasture land, and stock-keeping is not important apart from the breeding of camels which are the chief beasts of burden on the island.

The fishing industry employs a few hundred people. In 1933, when the number of craft based on Puerto de Naos and Puerto de Arrecife was 67 sailing-vessels of about 25 tons each and 264 small rowing-boats, the surplus fish was salted at four factories in Arrecife.

Ports

The only frequented ports of Lanzarote are about midway along the east coast at Arrecife where an extensive series of longshore reefs forms the two ports of Naos and Arrecife.

PUERTO DE NAOS AND PUERTO DE ARRECIFE (Lat. $28^{\circ} 58'$ N., long. $13^{\circ} 32'$ W. Population of district 5,118 in 1930).

Puerto de Naos lies in the shelter of Islote Cruces and the submerged reef adjoining it; on the south it is bounded by the Islote Francés. The harbour is small but secure, and has depths of between 9 and 19 feet over sand and mud. The northern entrance, between Arrecife de la Raya and the coast, has a depth of 7 to 11 feet and is generally used during winds from between north and east. The southern entrance, between the Islote Cruces reef and Arrecife del Peregil, has similar depths and is generally used when winds are from a southerly or westerly quarter (Fig. 32).

Puerto de Naos is important as a refuge for small shipping in stormy weather. There is a short quay on which one small crane was available in 1941. Large ships may obtain anchorage off the port in 18 to 22 fathoms of water.

The hamlet of Naos has a few dozen houses only and its inhabitants are mainly fishers. There is said to be a slip for ships up to 150 tons in the port.

Immediately south-west of Puerto de Naos and connected to it by a very shallow passage are the two basins (*charcas*) of S. Ginés and

Estila, which act as harbours for small boats and have access by a narrow boat-passage to the Puerto de Arrecife (Fig. 32).

The harbour of the latter port is mainly formed by the Islote de S. Gabriel and Arrecife Quebrado. This natural protection has been greatly increased by the construction of a breakwater from the

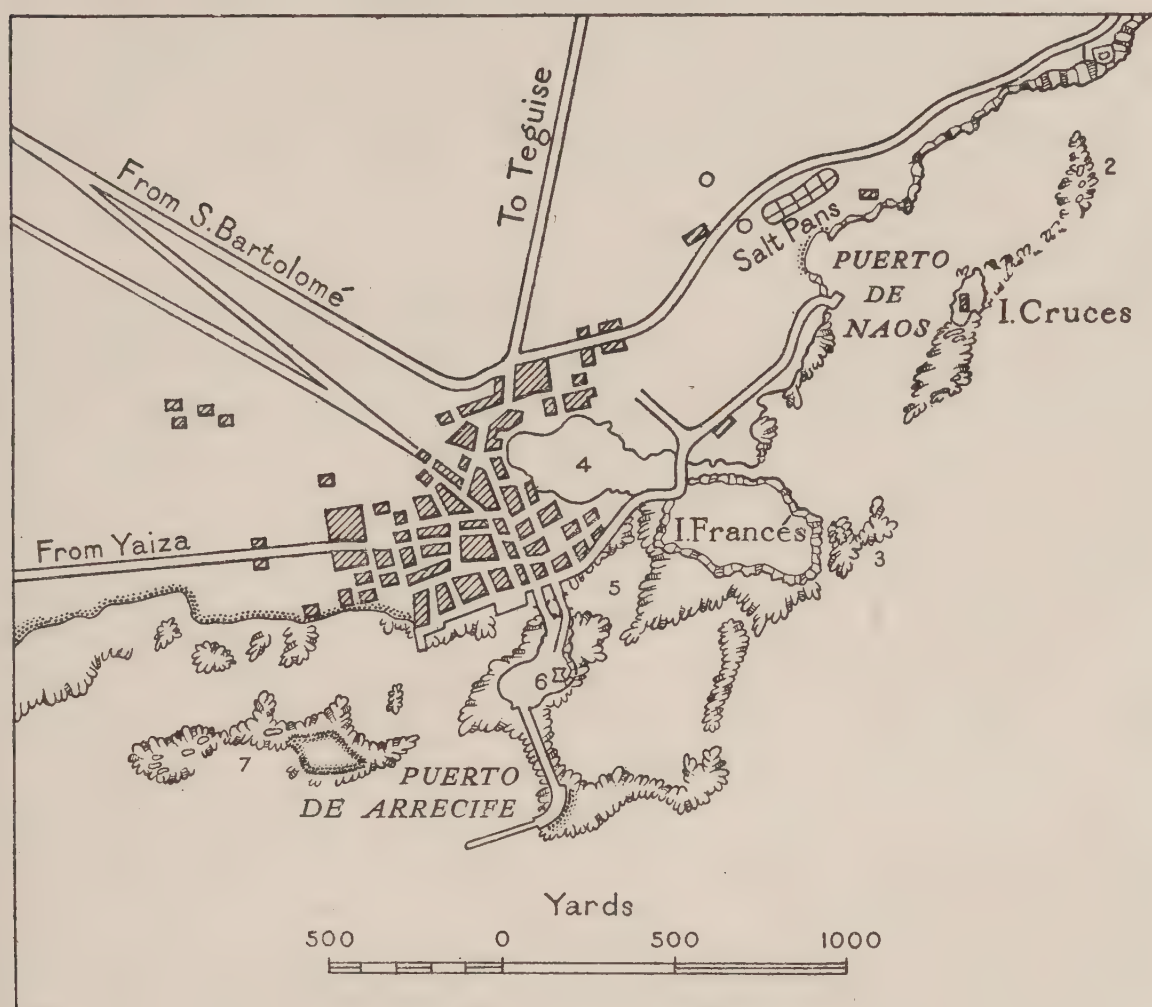


FIG. 32. *Plan of Arrecife*

1. Castillo de S. José; 2. Arrecife de la Raya; 3. Arrecife del Peregil; 4. Charca San Ginés; 5. Charca Estila; 6. Islote de S. Gabriel; 7. Arrecife Quebrado

southern end of S. Gabriel island. The pier is 670 feet long, and of this length 250 feet has a depth of 15 feet alongside at low water and will take vessels of up to 800 tons. There are, in addition, three moles accessible only to lighters, the one at any state of the tide (average rise and fall, 4 to 5 feet) and the other two at high water. One small crane, a few lighters, and a limited supply of water are available. Large ships may obtain anchorage in 17 to 30 fathoms in the roadstead south of Arrecife Quebrado, but this anchorage is exposed to southerly winds.

The town of Arrecife consists mainly of one-storied houses with flat roofs (Photo. 68). The buildings include an hotel and a theatre where cock-fights are held. The main imports are fuels, timber, and manufactured articles; the chief exports are cereals, white wine, vegetables (especially onions), and camels.

Roads suitable for automobiles lead north to Teguisse, north-west to S. Bartolomé, and west to Tias and Yaiza. The town is connected with Islote de S. Gabriel by a drawbridge which thus gives access to the fort on the island. There is a submarine cable to Puerto de Cabras in Fuerteventura (35 nautical miles).

Communications

Lanzarote has a few motorable roads, and numerous tracks which are the only means of inland communication in the island. There are three principle roads which radiate from Arrecife, one westwards to Yaiza, a second north-west to Tinajo, and a third north-east to Haría (Fig. 31). Surfaces are rough but adequate for motor traffic, and the roads have the advantage of commanding wide areas of country, owing to the lack of trees, shrubs, walls, or hedges. Although the road surfaces are usually dry and dusty, sudden storms will occasionally submerge the lower roads under 2 or 3 feet of water. Such floods, however, are never of long duration. Camels are the most commonly used beast of burden on the local tracks.

The road from Arrecife to Yaiza runs through fairly well-cultivated country south of the Montañas del Fuego. It leads out of Arrecife across a bare open plain, and past a reservoir, to more fertile scenery around the village of Tias (7 miles). Cultivated fields and vineyards extend over a gently undulating plain, its surface broken only occasionally by a few palm-trees, as the road continues to Uga (13 miles), where it is joined by a branch road from the centre of the island. The Montañas del Fuego rise abruptly to the north behind the last mile of this route to Yaiza (14 miles).

The route running north-west from Arrecife to Tinajo crosses the arid volcanic plateau which occupies the centre of the island. A straight stretch of road leads to the agricultural oasis around S. Bartolomé (5 miles) and thence to the cross-roads with the Teguisse-Uga branch road at Mozaga (6 miles). A gradual ascent to 1,000 feet is followed by a descent through open country to Tiagua. The road then turns westwards to its terminus at Tinajo (11 miles), which is connected with other villages near the north coast by local tracks.

Probably the route between Arrecife and Haría is the most im-

portant and frequently used in the island. After the first 4 miles the road divides into two branches, the main branch striking across the mountains, the other running round the eastern coast. The road first crosses the volcanic plain north-east of Arrecife to Tahiche (4 miles). Thence the main branch road turns to the north-west and ascends a slope to the small town of Teguisse (8 miles). The countryside overlooked by the ruins of the castle of S. Barbara has fields of wheat and occasional palm-trees as the road continues to the hamlet of Los Valles (12 miles). A winding but gentle climb leads thence to about 2,000 feet, whence a sharply curved abrupt descent reaches the cultivated countryside of the Haría valley (17 miles). Haría commands the tracks which serve the hamlets on the northern edge of the island such as Yé.

The coastal route to Haría runs in a north-easterly direction from Tahiche. It is bounded on either side by low hills as far as Guatiza (12 miles from Arrecife), whence the road surface deteriorates. The route lies along the coastal plain to the fishing-village of Arrieta, and then turns due west, winding up the hill-sides to enter the Haría valley from the eastern side (about 20 miles from Arrecife).

CANARY ISLANDS NORTH OF LANZAROTE

GRACIOSA

The islet of Graciosa is about $5\frac{1}{2}$ miles long, $2\frac{1}{2}$ miles wide, and $9\frac{1}{2}$ square miles in area. For the most part it is a flat lowland with four extinct volcanoes rising above it (Fig. 33). The volcanic cones are spaced at about mile-wide intervals down the centre of the island and rise abruptly from plains and undulating areas covered mainly with sand and lava. In the north is the reddish cone of Montaña Bermeja (550 ft.); dominating the stony lowlands of the centre of the island is the large imperfect crater of Montaña de las Agujas (870 ft.); a mile to the south-west of the latter is the smaller crater of Montaña del Mojon (500 ft.); in the extreme south, rising sheer from the coast, is the crater of Montaña Amarilla (520 ft.). The southern plains of Graciosa are covered with low hummocks capped with closely growing plants, the roots of which bind the sand; the flat ground between the hummocks consists of hard sand with a layer of shell-fragments. A wide belt of low sand-dunes separates this area from the south-eastern coast. Further details of the topography of Graciosa are shown in Fig. 33.

It is probable that a few insignificant trickles of water flow eastwards from the Montañas de las Agujas and del Mojon after heavy rains. Otherwise Graciosa completely lacks surface-water. The supply of drinking-water is small, the only source of fresh water, apart from rainfall, being just over a mile from the village on the south-eastern shore of the island. The restricted and shallow nature of the catchment areas makes it highly improbable that the present supply could be much augmented by borings.

The entire western coast of Graciosa is exposed to heavy seas and is fringed with enormous basaltic boulders. The northern and southern extremities of the island consist of high lava cliffs that rise precipitously from a rock-bound shore. The north-east, east, and south-east coasts are more sheltered from rough seas and are fringed for the most part with flat, waterworn reefs. On this side of Graciosa several small beaches occur, the only frequented one being that on the south-east coast which is used by the fishing-boats of the only village in the island. When not in use the craft are hauled high and dry upon the beach.

The inhabitants of Graciosa numbered 375 in 1937. The people, who are highly skilled in the management of small boats, depend

mainly on fishing for a living, since the arid, sandy soils and strong winds discourage agriculture. As much as possible of the surplus catch is dried by the fishers themselves. The only village on the island

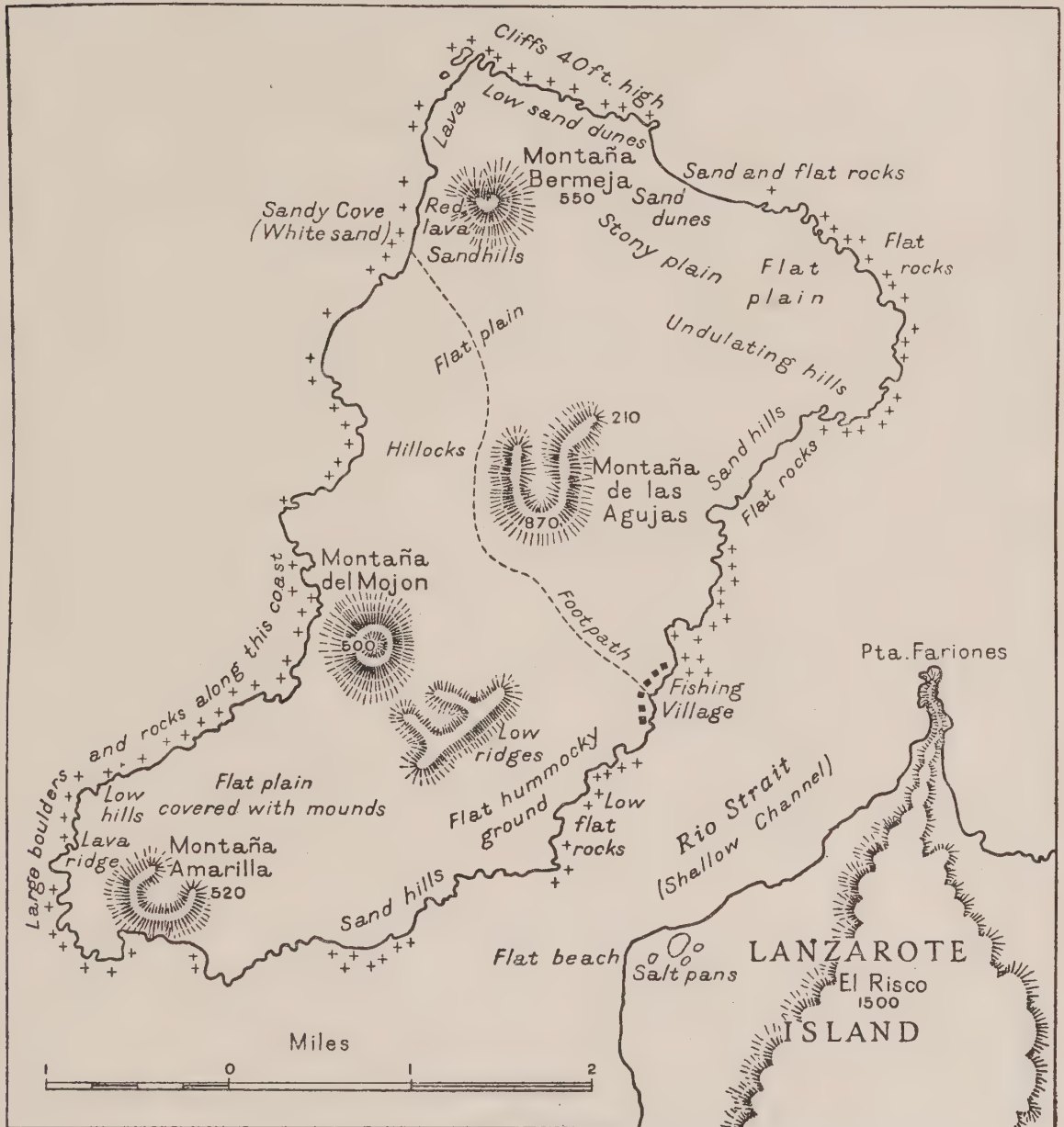


FIG. 33. *Graciosa (Canaries) Heights in feet*

consists of a line of single-storied stone buildings, roofed with brush-wood, built close to the main landing-beach (Fig. 33). Except for a few buildings two miles farther north, there are no other habitations. As Graciosa has very little vegetation (there being scarcely enough fodder to keep the few goats of the fishermen) it is rarely visited by botanists and its only attraction is its bird life, which includes the black oystercatcher and colonies of shearwaters. The only track on the island leads from the fishing-village to a small sandy cove on the north-west coast.

MONTAÑA CLARA

The small island of Montaña Clara is situated about $1\frac{1}{2}$ miles north-west of Graciosa and 5 miles south of Alegranza (Fig. 31). It is $1\frac{1}{4}$ miles long (north to south) by three-quarters of a mile broad, and covers an area of about half a square mile. Physically the island is a fragment of a volcanic crater, the rim of which is broken in the north to admit the sea. Except in the extreme south, the crater walls rise almost sheer from the shore, the culminating height being 811 feet. At the southern extremity of the island there is a small lowland which grades gently inland to a steep slope, 300 feet high, of lava and scorix. This slope is separated from the main walls of the crater by a flatter area consisting chiefly of small hills covered with fine ash, pumice, and blocks of lava.

Montaña Clara is very difficult of access except in the south, where the shore is low and shelving. Elsewhere, heavy seas crashing against high volcanic cliffs have produced a rock-bound coast abounding in caves, which form breeding-places for numerous colonies of birds, especially of shearwaters and petrels. This bird life is the only attraction of Montaña Clara. The island is uninhabited and quite barren, except for a sprinkling of plants on the low ground of the south; moreover, apart from occasional rains, the only drinking-water to be found is at a single water-hole that depends entirely on the meagre rainfall for replenishment.

ROQUE DEL OESTE

The Roque del Oeste lies about half a mile north-east of Montaña Clara (Fig. 31). The smallest of all the outlying islets of the Canaries, it covers only about 40,000 sq. yards ($8\frac{1}{2}$ acres) and is less than 30 feet above sea-level. The islet consists entirely of enormous blocks of lava and shelving walls of basalt which support practically no plant life. Landing on the island is hazardous at most times and is quite impossible in rough seas, hence the alternative name of Roque Inferno. There is a boat-passage between the rock and Montaña Clara and a deep-water channel between it and Alegranza.

ROQUE DEL ESTE

This barren islet lies about $8\frac{1}{3}$ miles east-north-east of Punta Fariones, the northernmost point of Lanzarote. It has a craggy summit and is surrounded by deep water on all but its south-eastern side, from which submerged rocks extend a short distance off shore.

ALEGRANZA

The oval-shaped island of Alegranza has a length of $2\frac{3}{4}$ miles, a width of $2\frac{1}{4}$ miles, and an approximate area of $3\frac{3}{4}$ square miles. The northernmost of the Canaries, it lies $5\frac{1}{2}$ miles north of Graciosa and 103 miles west of the African coast (Fig. 31).

The south-western half of the island consists of the Montaña de la Caldera, which rises to about 940 feet and retains a perfect crater, over 300 feet deep. In the north-east, beyond an intervening area of small hills, lava-covered slopes and stony plains, there is another volcanic mass of slightly lower altitude. The valleys of Alegranza are not true barrancos but are merely shallow depressions, in some of which sand has accumulated. Except near the coast, the relief lacks a rugged, boulder-strewn nature, and in parts rain-water has acted on the abundant volcanic dust to form a kind of 'macadam'.

Although a good deal of rain falls in some years, the island has no underground sources of water. The few inhabitants obtain their supply from rain-water, which is stored in two small reservoirs. It is said that the collection of rain-water could be greatly extended, for example by building a reservoir in the El Llano valley, but Alegranza seems too remote to attract the capital necessary for such developments.

The west coast of the island is very inaccessible, being formed mainly of high, precipitous cliffs with deep water alongside. For the most part, the south and east coasts are lower and are fronted by submerged rocks. In this area projections of half-drowned lava-flows form a shelter for a number of small creeks. The safest landing-place is near a large cavern on the south side of Alegranza where a rib of volcanic rock acts as a natural breakwater to a small sandy beach. This accumulation of sand terminates inland at a slope, 150 feet to 200 feet high, above which is a plateau with a stony, sandy surface that supports a sprinkling of vegetation.

In 1937 only 12 people were residing on Alegranza, these being the keepers of the lighthouse and their families. The total may, however, also include in some years a resident bailiff, who takes care of the island for its Spanish owner. The vegetation, although scanty, is more plentiful than in Graciosa and consists of the usual smaller types of plant life common to the east Canaries, the main peculiarity being Euphorbia bushes with abnormally thick stems. Wheat is cultivated in small patches. The fauna includes rabbits, a few semi-wild goats, and a vast number of Canarian shearwaters. The needs

of the lighthouse-keepers ensure that the island is visited regularly; in addition, fowlers from Lanzarote come each year for a month or so about August. They hunt the shearwaters with ferrets and nets in the same manner as they would rabbits. The birds are killed and plucked, some of the feathers being kept for domestic uses; the carcasses are crushed between stones to extract the oil, which is of commercial value, and the flesh is preserved for food. In some years as many as 10,000 shearwaters have been captured, and the meat has found a ready market in Lanzarote and Graciosa.

CHAPTER XI

THE MADEIRA GROUP

THE Madeira group consists of five islands, only two of which are inhabited (Fig. 34). The largest and by far the most important island of this group is Madeira, with an area of about 285 square miles; it is thus slightly larger than the Isle of Man (280 square miles), which it resembles in shape. The population of Madeira is roughly

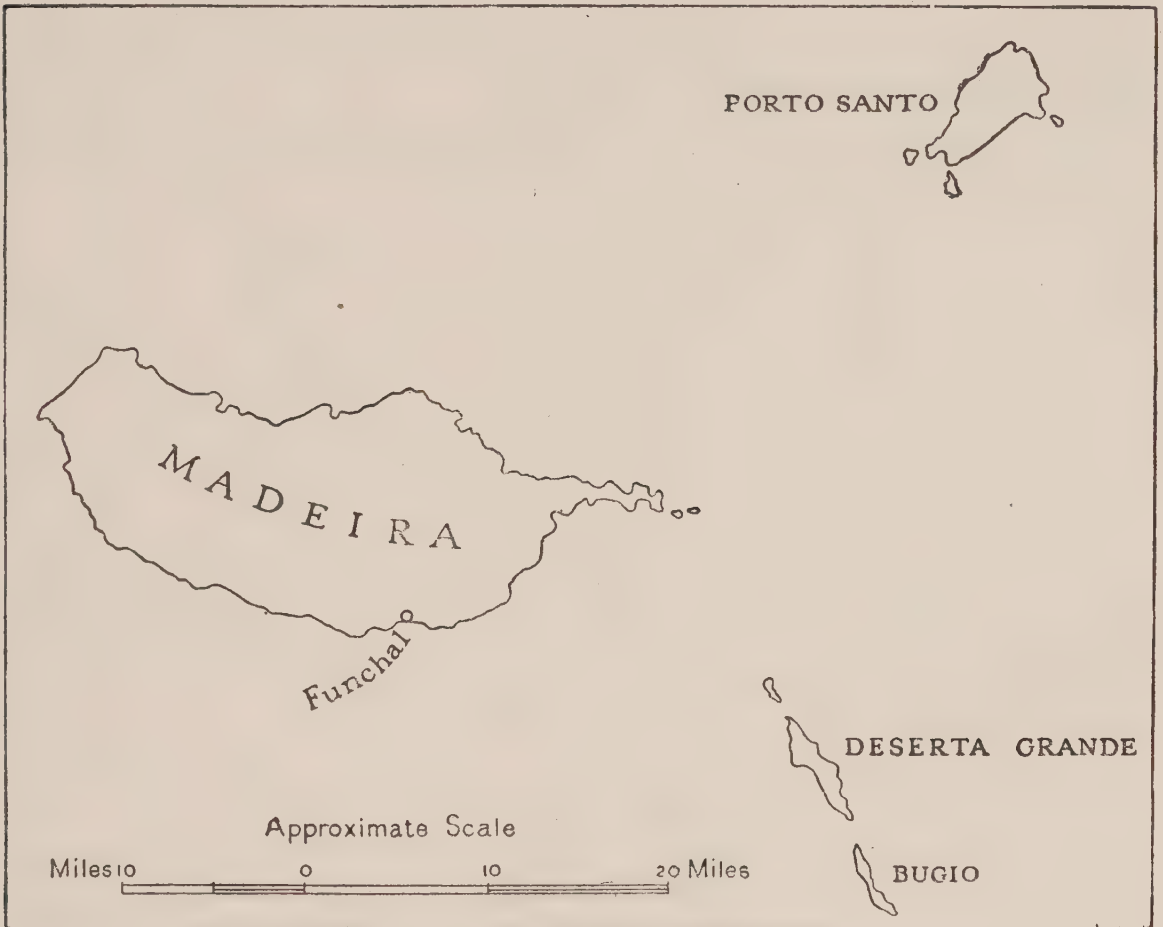


FIG. 34. *The Madeira Group*

a quarter of a million, and of this number 70,000 are concentrated in the neighbourhood of Funchal, the third largest city of Portugal. Madeira is, therefore, the most densely peopled of all the Atlantic islands.

Porto Santo is the only other inhabited island in the group. It lies 23 miles to the north-east of Madeira and is 7 miles long with an extreme breadth of 4 miles. Its only village is Vila Baleira, with 1,800 of the 2,500 inhabitants of the island.

The Desertas are three uninhabited islands that lie 10 miles south-east of Madeira and extend in a chain 14 miles long; they are occasionally visited by fishermen and sportsmen. Deserta Grande, the largest island, is 7 miles long and a mile wide in its broadest part. To the north of Deserta Grande is Chão, a mile long and a quarter of a mile wide, while to the south lies Bugio, 4 miles long and half a mile wide.

The Selvagens (Salvage islands) are two groups of rocky uninhabited islands, 135 miles from Madeira and placed between it and the Canaries. The Selvagens are under Portuguese control. Selvagem Grande, 3 miles in circumference, is the largest of the islands, while a second group of two small islands known as Selvagem Pequena and Ilhéu de Fora lie to the south-west of it.

The total population of the Madeira group, according to recent censuses, is given in the following table:

<i>Date</i>	<i>Population</i>
1861	101,420
1890	134,040
1900	150,574
1910	169,783
1920	179,002
1930	211,607
1940	249,138

Since 1920 the increase of the population of Madeira has been very substantial. This increase has been mainly due to the various restrictions which have limited the volume of emigration from the island, and especially to the United States.



FIG. 35. *Relief of Madeira*

MADEIRA

PHYSICAL GEOGRAPHY

Relief

Madeira has an extreme length of 35 miles (Ponta do Pargo to Ilhéu de Fora) and a maximum width of 13 miles (Ponta de S. Jorge to Ponta da Cruz). Although the island is of volcanic origin, it has only three real craters on it, those near Porto Moniz and Fanal in the north-west, and that of S. Antonio da Serra in the east. All these craters are small and are insignificant features of the general landscape. Vestiges of other craters occur, for example, on Pico do Caniço and numerous other hills near Funchal, but they are far outnumbered by cones and humps of ash and scoriae, which are especially common on the ridge stretching north-westwards from the Ribeira Brava. Hence it appears that the island is essentially the product of a great many volcanic vents and that its mountainous nature is the result of erosion rather than of violent vulcanism. The oval, dome-shaped mass of lavas and tuffs forming Madeira has been so deeply eroded by running-water that the main feature of the present relief is a basaltic range of mountains running from east to west along the length of the island. From the rugged crest of this range, numerous ridges, separated by stupendous ravines, project seawards to the coast, where most of them terminate in high cliffs. Usually the slopes on the north side of the main watershed are more precipitous than those on the south, but everywhere the gradients are steep and the valley-sides abrupt. Madeira is in fact the most dissected of all the Atlantic islands discussed in this book (Fig. 35).

To the east of Madeira is the Ilhéu de Fora, a small islet, bordered by rocky cliffs except at its south-eastern side where it slopes to the sea and offers the easiest landing. The surface of the islet, which is covered with a light, stony soil and sand, rises at the extreme north to a peak about 315 feet high. A boat-passage separates the Ilhéu de Fora from a narrow irregular rocky peninsula with a fairly flat summit between 250 and 300 feet above sea-level. This peninsula is just separated at high water from the mainland. The main island proper begins at Ponta do Furado and stretches thence as a hilly peninsula, about $3\frac{1}{4}$ miles long by one-quarter to three-quarters of a mile wide to the neighbourhood of Caniçal. This long, narrow neck of land, the Ponta de S. Lourenço, is hilly and has summit heights of 450 to 500 feet (Photo. 69).

From Caniçal westwards to the longitudes of Funchal and Ponta de Santana the main ridge rises from 2,000 feet north of Machico to over 5,500 feet at the Pico do Cedro and Pico do Arieiro. Numerous valleys incise the southern slopes, which are relatively gentle and are broken in places by volcanic plugs and cones; the northern slopes are more precipitous and are deeply dissected by ravines. The only considerable area of fairly flat land in all this eastern part of the island is the rolling tableland at S. Antonio da Serra, 3 miles west of Machico.

The central mass of Madeira, from the longitude of Funchal to that of S. Vicente and Ponta do Sol, is remarkable for its deep dissection. Here, into an upland mostly at 4,500 feet to 6,000 feet, the head-streams of the Ribeira Brava and the Ribeira dos Socorridos have cut two vast circular amphitheatres. These great hollows consist of an irregular arrangement of gorges (with floors at 1,600 to 2,600 ft.) that are overlooked by mighty precipices and rugged peaks with summit heights of 3,000 to 6,000 feet (Photo. 70). The two depressions are partly separated by a narrow north-south ridge which rises to 5,436 feet in Pico Grande; they are dominated on the north and on the south by a high mountain range. The ridge on the south is breached by the canyons of the Curral das Freiras (Grande Curral) and the Ribeira Brava (Serra de Agua); it maintains a general height of 3,000 to 4,500 feet and descends southwards fairly evenly to a cliffed coast. The northern ridge is narrow and high, its seaward slopes being precipitous and its river-valleys, although shorter than those on the south, being more deeply incised. This ridge commences in the west near Pico Ruivo (6,105 ft.), the culminating point of the island, and thence to the Paul da Serra maintains a summit height of between 3,500 and 4,500 feet. The northern slopes of this ridge are very steep and consist of an alternation of deep canyons and lofty, abrupt-sided buttresses that terminate in precipices on the seaward side.

A few miles west of the main road from S. Vicente to Ribeira Brava, the two main ridges of the central mass of Madeira converge to form the Paul da Serra, a wide plateau lying at between 4,000 and 5,000 feet above sea-level. This tableland, the most extensive area of flat land in the island, is situated about midway between the north and south coasts. The drop southwards is longer, more regular, and less precipitous than that to the north, where a great spur projects from the tableland northwards towards Seixal.

West of the Paul da Serra the main watershed lies about midway between the coasts. The southern slopes are fairly regular, whereas

those on the north are incised by the great ravines of the Ribeira do Seixal and Ribeira da Janela. These two gorges are separated by a tremendous spur which projects north-westwards from the Paul da Serra to the neighbourhood of Janela, where, at a distance of 2 miles from the sea, its summit still exceeds 3,000 feet.

Drainage and Water-supply

Madeira is drained by numerous streams which radiate seawards from the central watershed. Although few of these rivers exceed 9 miles in length, their valleys are unusually large. The chief rivers are as follows: on the east coast, the Ribeira de Machico, which furrows the rugged slopes to the north of the town of that name; on the south coast, the Ribeira dos Socorridos (which rises in the great amphitheatre of the Curral das Freiras), the Ribeira Brava, and the Ribeira da Ponta do Sol; on the north coast, the swiftly flowing ribeiras of Faial, S. Jorge, S. Vicente, Seixal, and Janela, the last named being the longest river on the island. With few exceptions these valleys have similar characteristics. They are gorge-like and their rocky, precipitous sides vary in height from several hundreds, or even thousands, of feet near their sources to a few score of feet near their mouths; their beds seldom carry much water except in the rainy season; their tributary valleys develop into a herring-bone system, since the short, swift rills arise on the flanks of the main ravine. To these physical characteristics must largely be attributed the fact that few of the valleys are used as routeways and all are impracticable to cross except near their mouths.

The water-supply is abundant owing to the numerous springs and streams on the mountain ridge. During winter most of the streams are raging torrents. In summer the yield of the springs falls by about 20 per cent. and all the stream-beds on the southern slopes are normally dry. Many of those on the north, having more water than is wanted for irrigation purposes, continue to run, but with a much diminished flow (Photo. 71). Springs are especially copious and plentiful on the western flanks of the Paul da Serra near Rabaçal, where, also, there is a permanent waterfall (on the Risco, a headstream of the Ribeira da Janela) that drops 300 feet into a large pool.

Nearly all the water used in Funchal is conveyed in 3-inch iron pipes from springs at Corujeira near the 'Mount Church' (Nossa Senhora do Monte). Most of the houses are provided with this water, and some of the hotels have private supply lines. There is also a supply from public fountains. The municipal reservoir (capacity

7,000 tons) stands about 900 feet above the town, which has two smaller tanks with a total capacity of 300 tons for its own use. The supply of water for irrigation purposes is a much greater problem than the procuring of a local drinking-supply. The drier, lower slopes of Madeira are irrigated by means of artificial watercourses (*levadas*) which are constructed of stone and plaster or are cut in the rock itself (Photo. 72). The *levadas* follow the sides of many of the valleys and have been built almost heedless of expense and physical obstacles, going in and out of ravines, and tunnelling under spurs and even under the main watersheds. Among the major undertakings of this kind are those commencing near Rabaçal, whence water is taken through the main ridge to the southern slopes of the island. Further details of this intricate network of irrigation channels are given on pp. 236–237. It should be noticed that this water, which is open to the air and so to pollution, is not suitable for drinking purposes. On the other hand, many of the *levadas* form excellent, if nerve-racking, footways in the dissected, mountainous parts of central Madeira.

Vegetation

The botanical aspects and the general vertical distribution of vegetation in Madeira have already been discussed (pp. 39–46); the regional distribution is more difficult to analyse, since the country, owing to its dissected nature, cannot be divided satisfactorily into regions.

As a rule, agriculture predominates up to 2,000 feet, above which it occupies a rapidly decreasing proportion of the land and practically ceases altogether at 3,000 feet. Cultivation, often in narrow, steep terraces, utilizes much of the north-eastern parts of the island and a high proportion of the mountain slopes, below 2,000 feet, on the south coast. This cultivated area, however, includes the plantations of timber trees, usually of cluster pine. Woods of pine, planted very thickly, cover large tracts of the hill slopes at heights of 1,500 feet up to 2,700 feet inland from the south coast most of the way from Ponta do Pargo to Machico. In the east they practically terminate on the slopes of the plateau of S. Antonio da Serra, a grassy tableland almost surrounded by pine-groves.

In contrast with this extensive reafforestation of the south coast, the timber plantations near the north coast are small, and consist mainly of pine woods on the hills above Porto Moniz, S. Jorge, and Santana. The more precipitous slopes facing this coast support a natural growth of woods and thickets, often of evergreens, which



69. *Ponta de S. Lourenço, Madeira*



70. *Grande Curral*



71. *Ribeiro Frio*



72. *Irrigation Canal (levada)*

stretches inland up the sides of the great ravines almost to the main watershed. In the central parts of Madeira the vast amphitheatres of the Ribeira Brava and Ribeira dos Socorridos (Grande Curral) are also covered with trees and shrubs which usually dominate an undergrowth of ferns.

Above 3,000 feet the plant-cover consists mainly of bay laurel, til, vinatico, heather, bilberry, and grasses. From 4,000 feet upwards the vegetation becomes appreciably scantier until at heights above 5,000 feet it usually deteriorates into short grasses. There are four main areas in Madeira where the plant-cover is very thin. The first is the high, broad ridge of the main watershed north of Funchal and Camacha where the scenery is moor-like, and a wide expanse of short moorland grasses is dotted with clumps of bracken and bushes of bilberry, broom, and gorse. The second is the high hills between, and south of, the amphitheatres of the Ribeira Brava and the Ribeira dos Socorridos, where grasses and bracken predominate except on the wetter slopes, which are shrub-clad. The third area of thin plant-cover is the high, narrow ridge stretching between the headwaters of the Ribeira do Faial and the Ribeira de S. Vicente, where the vegetation consists of moorland grasses on the flatter areas and of a low shrub of heather and bilberry on the damper slopes. The last of the four regions of thin plant-cover is the extensive plateau of the Paul da Serra and the summits of the large spurs projecting from it. This plateau is almost bare in parts, but generally supports a low covering of moorland grasses, sprinkled in some localities with St. John's wort and in others with dwarf shrubs. In winter the Paul da Serra is subject to frequent mists and its dreary surface closely resembles a marshy moorland.

Coasts

In Madeira the slopes are everywhere abrupt, the average height of the island being 2,660 feet with one peak over 6,000 feet, while the oceanic depths near the island descend to between 13,000 and 16,000 feet. The coasts, which are about 90 miles long, are abrupt and precipitous in all parts of the island, with few beaches and no natural harbours (Fig. 36). The southern coast is more accessible than the north, with a more gentle slope to the interior ranges and a larger population. The only large town and port, that of Funchal, lies in the south-east, where there is a comparatively safe roadstead occupying a slight break in the abrupt coastline.

The north coast, which extends from Ilhéu de Fora to Ponta do

Pargo, has two outstanding promontories, the Ponta de S. Jorge in the centre and the rounded shoulder between Ilhéu Mole and Ponta do Tristão in the west. This stretch of coast, about 43 miles long, has very few safe anchorages or landing-places, and these are used only by local fishing craft owing to the constant heavy seas.

Between Ilhéu de Fora and Ponta de S. Jorge the hills rise steeply to 2,450 feet in the east and 1,700 feet in the west within 1 mile of the cliffs. These slopes are thickly covered with dense vegetation, particularly near the deeply incised valleys of the many small streams, but the cliffs themselves fall so abruptly to the sea that bushes can only secure a foothold in the most favoured places. The outstanding features of the coast are (1) the rocky projection of the peninsula of



FIG. 36. *Madeira from the east-south-east*

S. Lourenço, which with its two off-lying islets forms a long narrow addition to the island in the east; (2) the continuous fringe of rocks near the coast, some of them forming small islets; (3) the prominent black Ponta do Clérigo, which rises immediately to a peak 1,740 feet high; and (4) the sheer red 700-foot cliffs near Ponta de S. Jorge. The main villages on the shore are Porto da Cruz, where there is a small rock-encumbered bight with a steep boulder beach, probably the best landing-place on the north coast; Faial, a small hamlet lying above a rocky beach where a small 50-foot jetty has been built for the use of fishing-boats; and Porto de S. Jorge, which consists of a few houses grouped at the mouth of the S. Jorge stream. The greater part of the hamlets of Faial, Santana, and S. Jorge are built above the cliffs, and their cottages on the terraced hillsides are visible from the sea. Tracks connect the villages in the west, but there are only paths east of Porto da Cruz (Photo. 73). A motorable road leads across the island from Faial to Funchal (19 miles).

High wooded mountains between 2,800 and 3,300 feet shut in the 20-mile stretch of coast between Ponta de S. Jorge and Ponta do Tristão, descending only in the extreme north-west to 2,000 feet. From these heights the cliffs fall precipitously into the sea, their sides deeply furrowed by ravines. The coast is gently concave in shape, with the blunt Ponta Delgada, its sides scattered with white houses intermingled with terraced vineyards, the low promontory of Seixal, and

the islet of Mole as the most prominent features. The coast is difficult of access and the landing-places are all poor, though fishing-boats use the small pebble beaches at the east side of Ponta Delgada, at the mouth of the S. Vicente stream, at Seixal, and in the shelter of Ilhéu Mole. A motorable road runs close to the cliffs between Ponta Delgada and S. Vicente (5 miles), and then continues across the mountains to the south coast at Ribeira Brava ($13\frac{1}{2}$ miles). All the coastal villages west of S. Vicente are completely isolated from motor roads.

Unbroken cliffs, lined by a narrow fringe of pebble beaches, form the 5 miles of coastline between Ponta do Tristão and Ponta do Pargo. The mountains rise to 3,000 feet within $2\frac{1}{2}$ miles of the shore, and from them torrents rush down to the sea. The debris of two large landslips on the coast have been terraced and used as vineyards; as a whole, the houses and tracks avoid the cliff edge.

The south coast, which is roughly 46 miles long, trends in a south-west direction between Ilhéu de Fora and Ponta do Garajão, then opens out into the Bay of Funchal, and between Ponta da Cruz and Ponta do Pargo turns gradually to the north-west. There are several small fishing anchorages and landing-places on this coast, but Funchal is the only port with equipment for handling large vessels.

The 16 miles of coast between Ilhéu de Fora and Ponta do Garajão consist of cliffed headlands separating small bays, the slopes being normally less abrupt than on the north coast. The land behind the coast rises fairly steeply to 1,500 feet. Several comparatively large streams enter this coast, and at their mouths stand the larger villages. The most outstanding promontories are the Ponta de S. Catarina, between the bays of Machico and S. Cruz, and Ponta do Garajão, which has almost vertical basaltic cliffs. Large caves have been hollowed out of the basalt cliffs to the south of Machico, and to the north of that village there is a sandy stretch of beach which has curious fossilized trees. The coastal villages are Caniçal, a small settlement with a stony beach occasionally used by fishing-boats; Machico, one of the larger villages of Madeira, occupying the terraced slopes of a valley above a pebble beach where small boats can be drawn up; S. Cruz, a village at the head of a small bight; and Porto Novo, a tiny hamlet near a very restricted sandy beach. One of the best roads in Madeira runs along the coast between Machico and Porto Novo, in many places at the very edge of the shore.

The bay of Funchal, which is about $5\frac{1}{2}$ miles long, forms a slight indentation in the coast between Ponta do Garajão and Ponta da

Cruz. Its shores are rocky and cliffed both on the east and on the west, where several rocks and islets lie off the coast. A long pebbly beach, however, extends along the centre of the bay and is bordered by a sea-wall and wide road, behind which rise the main buildings of the town. A breakwater has been built out from the peninsula of Pontinha on the western side of the harbour, and is used as a protection for smaller vessels. Around the shores of the bay live about one-third of the population of the island, and all the main motorable roads are connected to the town.

The coast is steeply cliffed between Ponta do Cruz and Ponta do Pargo, the only breaks being the many deeply incised barrancos. Within 3 miles of the shore the mountains rise to 3,000 feet and are usually thickly covered with vegetation. The more accessible parts of the coast are terraced for vines and the abrupt cliffs are often patched with wild geranium, broom, cactus, and prickly pear. The most prominent headlands are Cabo Girão, which falls sheer to the sea from 1,885 feet, its face scored by building-stone quarries, and the conspicuous low bluff of Ponta do Sol, covered with small white cottages. There is an almost continuous ribbon of settlement along the coast. Landing is possible at Praia Formosa, a beach on the western flank of Ponta da Cruz; Câmara de Lobos, a busy fishing-village at the mouth of the Ribeira dos Socorridos; Ribeira Brava, lying in the shelter of Cabo Girão; Ponta do Sol, which has a very restricted beach; Madalena do Mar, placed on terraced cliffs above a shingle beach; and Paul do Mar, a small village built on the debris of a landslip below very lofty cliffs (Photos. 74 and 75). A coastal road runs fairly close to the shore as far as Ponta do Sol, but keeps thereafter from one-half to a mile inland.

HUMAN GEOGRAPHY

Distribution of Population

In 1930 the population of Madeira was 209,111 and the average density of settlement 735 persons to the square mile. The latter figure, although the highest in the Atlantic islands, gives little idea of the local density of population, since over two-thirds of the island consists of rugged highland, uncultivated and uninhabited. Above 2,500 feet there are very few houses, and above 3,000 feet settlement and agricultural activities practically cease (Fig. 38). It is probably no exaggeration to say that 90 per cent. of the total population lives below 1,500 feet and within 3 miles of the sea. This coastal distribu-



73. *Porto da Cruz from the south*



74. *Madalena do Mar*



75. *Paul do Mar*



76. *S. Antonio da Serra*

tion, however, is very unevenly balanced, and only 26,000 people, less than 10 per cent. of Madeira's total population, live on the steep slopes north of the main watershed, whereas the less precipitous southern slopes support over 90 per cent. of the people. The population of the urban and rural municipalities (*concelhos*) of Madeira is given in the following table:

<i>Concelho</i>	<i>Population in 1930</i>
Calheta	21,960
Câmara de Lobos	21,814
Funchal	68,003
Machico	17,463
Ponta do Sol	13,190
Porto Moniz	5,058
Ribeira Brava	16,343
Santana	10,910
S. Cruz	24,707
S. Vicente	9,663
TOTAL	209,111

Apart from Funchal, the chief settlements of Madeira are little more than overgrown villages, the largest of which (Machico and Câmara de Lobos) probably do not exceed 5,000 inhabitants. The typical Madeiran town contains one or two short streets and a considerable number of outlying houses, in which, in many *concelhos*, the majority of the people live. The villages and hamlets, especially in rugged country, usually consist of scattered buildings, little superior to huts, with walls of stone and roofs of thatch that rises in a ridged fashion to a central point. From a distance these straw-thatched dwellings surmounting the foliage of terraced gardens and orchards closely resemble colonies of beehives. Throughout the island, local volcanic rock, chiefly basalt, forms the main building material, but plaster is frequently used in the towns. The roofs of most of the houses in the larger settlements are of tiles, although outhouses and sheds may be thatched in the traditional style. The town dwellings, especially in Funchal, are well constructed and often have a courtyard that is shaded by vines. On the other hand, in parts of the lower coastal zone the labourers on the banana and sugar-cane plantations build primitive houses of stone, with tiled roofs, which, however, they seldom use except in times of inclement weather.

Regional Distribution. In the extreme east of the island there are few habitations, since Ponta de S. Lourenço and the small off-lying islands are of little use for agriculture. The only village is Caniçal, which contains no more than a few dozen houses. About 2 miles to

the south-west is Machico, the chief town of a parish of 10,000 people. The main part of the town has grown up on a small plain at the mouth of the Ribeira de Machico facing a sandy beach about 600 yards long. On the south bank of the stream a thin band of houses stretches inland from the shore for about half a mile; on the north bank the buildings are more scattered and include the Capella de S. Isabel dos Milagres, a chapel erected on the traditional burial-place of Robert à Machin and his wife. Although often called Porto de Machico, the town has no facilities for ships except a sheltered bay and a sandy beach much used by local fishing-craft. Isolated houses stretch up the valley inland from the town as far as the grassy upland near S. Antonio da Serra, a summer resort that consists of scattered dwellings with here and there a cooking-house (Photo. 76). Upon the hill-slopes of the coastal area south-east of Machico, isolated houses and hamlets are common. Wherever the cliffs give way to a beach a village arises, and S. Cruz, a collection of white and yellow houses at the mouth of a deep gully, is the largest settlement of a parish of 9,000 people. On the pine-clad slopes inland are the two small towns of Camacha (4,500 people in parish) and Caniço. The former, dispersed about a broad, grassy common at 2,000 feet above the sea, has become the summer residence of many members of the British colony in Funchal. The latter is more agricultural, and most of the inhabitants of the parish (6,300 in number) live in outlying houses.

Funchal concelho (68,000 people) contains nearly one-third of the total population of the island. The town itself had nearly 32,000 inhabitants in 1930, but outside it and extending nearly 2 miles from its centre and up to 2,600 feet altitude, are numerous isolated *quintas* or private dwellings, many of them palatial and set in extensive terraced gardens. A description of Funchal and of its port is given on pp. 242-247.

Westwards of the capital, beyond the high hills of S. Martinho, lies the great valley of the Ribeira dos Socorridos. Owing to the deep dissection accomplished by this river, some terraced agriculture and a few hundred isolated dwellings occur in the canyon-bottoms of the Grande Curral at 5 or 6 miles from the sea. On the west side of the mouth of the ravine, grouped around a small creek, is the fishing-town of Câmara de Lobos, the chief settlement of a parish of 11,000 people. North of the town, widely scattered dwellings stretch for several miles up the terraced and pine-clad slopes (Photo. 77).

The coastlands immediately to the west of this area are sparsely peopled except at the mouth of the Ribeira Brava, where a small

lowland has favoured the growth of Ribeira Brava, a fishing-town with several thousand inhabitants. The dwellings stretch from the beach up the river for nearly three-quarters of a mile, but then the walls of the ravine become too steep for settlement and few houses occur until the valley widens out in the amphitheatre of Serra de Agua, where some 1,800 persons obtain a living from terrace agriculture.

West of Ribeira Brava the pattern of settlement on the south coast scarcely changes, the cultivators of the slopes below 2,500 feet living in scattered cottages, while the fishers and agriculturists of the coastal strip congregate in villages at the mouths of the main valleys. The coastal towns of Tabua, Madalena do Mar, Calheta, and Paul do Mar (which has a tunny cannery) are the chief settlements of parishes of 3,000 to 5,000 people; Ponta do Sol has a landing-stage and is slightly larger, being the head of a parish of 7,000 inhabitants.

On the extreme west of the southern coast and on the western coast of Madeira, high precipitous cliffs force the settlements away from the seaboard. The main villages, such as Fajã da Ovelha and Ponta do Pargo (each in a parish of 2,500 people), are at least three-quarters of a mile from the coast.

The distribution of population on the north coast of Madeira is restricted by the precipitous relief to the river valleys and to the gentler slopes inland from the coast between Arco de S. Jorge and Porto da Cruz. In the north-west, Porto Moniz, a village of a few hundred people, has grown up on the cultivated slopes at the foot of precipices. Equally small and equally isolated on the landward side are Seixal and Ribeira da Janela, the former on a promontory of relatively recent lava, and the latter perched high above the mouth of the river bearing the same name. There are practically no habitations on the steep spurs east of Seixal until the valley of the Ribeira de S. Vicente is reached. Here the village of S. Vicente, consisting of a wineshop with a few adjoining houses, is the only considerable group of dwellings in a parish of 6,000 persons, since the greater proportion of the agriculturists prefer to live in isolated cottages. Eastwards uninhabited precipices prevail until the abrupt cliffs recede a little from the shore near Ponta Delgada (1,800 in parish) and again near Boaventura, where terrace agriculture is possible.

Between Arco de S. Jorge and Porto da Cruz the cultivable area increases greatly in size so that agriculture, including plantations of sugar-cane, sweet-potato, and yam, spreads up the hill-sides in much the same way as it does near the southern coast of Madeira. About 15,000 people live in this district, the chief settlements being

Arco de S. Jorge, S. Jorge, Santana, Faial, S. Roque, and Porto da Cruz; only the last resembles a village, the remainder being merely a loose collection of houses, although they have the advantage of road connexions with Funchal. It is noticeable how thatched cottages, each in a yam garden, straggle at wide intervals along these routes almost up to the main watershed of the island (Photo. 78).

Industries

Mining and Manufacturing. There is no mining in Madeira nor, although small surface workings abound, is there any large-scale quarrying of stone, the only important quarry being one for basalt about 1 mile north of Câmara de Lobos. A small quantity of limestone is quarried at one spot on the eastern flanks of the valley of the Ribeira de S. Vicente, not far from the town of that name.

Manufacturing is largely restricted to the making of embroidery, wickerwork, and other artistic articles for export and sale to tourists, and to the preparation of foodstuffs for the home market. Funchal, the centre of all these industries, has a large modern bakery and flour-mill, a brewery, two sugar-factories, one or two saw-mills, and a small tobacco factory. Just to the east of the town is a pottery works which turns out, partly from imported clay, tiles, terra-cotta vases, and large earthenware vessels. The small-scale manufacture of imitation flowers, jewellery, marqueterie, and of walking-sticks and the handling and selling of embroidery and wickerwork are all concentrated in Funchal.

The electric plant of the city is situated about two-thirds of the way from the pier to Garajão point. The plant develops 4,000 h.p., but a new unit of 1,000-h.p. rating was about to be installed in 1940. The average load is approximately 10,000 kW. Distribution feeders serve almost all the southern areas of Madeira, and special feeders are run to some of the larger factories in Funchal, notably to the main sugar refinery and the engineering works (p. 247).

Hand-embroidery employs a considerable proportion of the female population, about 20,000 workers being engaged on it. The work was first introduced by an Englishwoman, Mrs. Phelps, who in 1850 started a school of embroidery in Funchal. The people showed a remarkable aptitude for the craft, which is now mainly carried on in country districts, the women, and even girls of 7, sitting in the open and industriously plying their needles between their household tasks. There are in addition a few thousand professional or full-time workers who dwell in the Funchal area and produce the finest



77. *Câmara de Lobos*



78. *Porto da Cruz*



79. *Wickerwork Industry*



80. *Scabbard Fish*

embroideries. The work, which includes lace-making, is done by hand, usually on fine Irish linen; it is distributed and collected by companies who pay at piece-rates, the usual earnings being seldom more than a few pence a day. The export companies confine themselves largely to cutting out the pieces to be embroidered, stamping the designs on them, distributing them by their travelling agents, and giving them the finishing touches when they are received back from the embroiderers. The export in some years has been considerable, and there is also a large sale to tourists.

The fashioning of wickerwork articles is mainly carried on near Camacha, where the finest osiers grow. Much willow is exported as such to South Africa and other countries; the remainder is worked up locally into chairs, baskets, tables, and similar goods, which are carried to Funchal by the women, some of whom can manage half a dozen chairs on their heads at once. A certain amount of coarse baskets and packages are retained for local use (Photo. 79).

Agriculture and Fishing

Land Utilization. Approximately 50,000 acres of Madeira are under agriculture, and this area, because of the dissected nature of the relief, is broken up into such small and scattered properties that its cultivation entails an inordinate expenditure of time and labour. Although cultivated fields rarely extend more than $2\frac{1}{2}$ miles inland on the south side of the island and $1\frac{1}{2}$ miles inland on the north side, two-thirds of the population obtain a living from agriculture. The soil, where present, is very fertile, and if water is available yields abundantly. This fertility has encouraged the peasants to spend much time in the erection of walls to prevent soil-wash and in the building-up of plots of ground into artificial terraces. The land on the lower levels, which is naturally the most productive, is mainly owned by large proprietors who employ a certain amount of hired labour, but at higher levels the holdings are small and not infrequently terraced, each being separated from the other by stone walls or cactus hedges or by the sheer sides of the terraces themselves. These small holdings are cultivated by the occupants at the expense of incessant toil, the burden of which falls chiefly on the women. During summer, tillage and harvest are often carried on far into the night. The peasant cultivators are skilled gardeners, but they are not eager to learn new methods and make little attempt at organization or co-operation.

The variety of crops which can be grown is greatly increased by the

different temperatures that occur on the steep coastal slopes. The plants naturally show a certain resilience to climate and there is much overlapping of the so-called crop zones, but as a general rule the following zones may be distinguished.

From sea-level up to 1,000 feet is the Sugar-cane Zone, which may be subdivided into a Coffee Zone (up to 500 ft.) and a Fig Zone (500 to 1,000 ft.). In the coffee zone, bananas and sugar-cane of the finest quality, pine-apples (in forcing houses), tamarind, and dates are characteristic; in the fig zone, the sugar-cane, banana, fig, avocada pear, custard apple (*anona*), sweet potato, and prickly pear predominate.

From 1,000 feet up to nearly 2,000 feet is the Wine Zone. Here the vine, melon, peach, custard apple, mulberry, orange, citron, mango, pomegranate, prickly pear, yam, sweet potato, cereals, and osiers are the chief crops.

From 1,600 feet up to 2,600 feet is the main Vegetable Zone, the characteristic crops being the artichoke, carrot, cabbage, spinach, beans of various kinds, pumpkin, potato, and onion.

From 2,000 feet up to 3,200 feet is the Temperate Fruit Zone, where the apple, pear, chestnut, plum, peach, apricot, and quince are the leading cultivations and forestry is also important.

Finally comes the Highland Zone where, locally, forest cultivation and nut trees extend up to nearly 4,000 feet, beyond which grazing land, often of a rough nature, prevails.

Many of the crops named above in the Vegetable, Wine, and Sugar-cane Zones rely for their full growth on irrigation, without the aid of which Madeira would produce a very small percentage of its present yield. The irrigation system of the island depends on canals or levadas which originate in the headcombes of the ribeiras and wind about for miles before reaching the cultivated fields, where the water is dealt out for a period of several hours on stated dates to the landowners who have acquired a right to it. The network of stone channels began to spread in the fifteenth century when slave-labour was available and has increased to-day to several hundreds of miles. The longest project is the Levada do Juncal, which begins under Pico Ruivo and passes through the Metade valley to Ribeiro Frio and the Lamaceiro pass (where it is called the Levada do Furado) and so to the neighbourhood of S. Antonio da Serra, whence it proceeds to Camacha and the hills above Funchal. Its total length, including several branches, exceeds 70 miles. Other important levadas are the Queimadas, which commences in the Ribeira de

S. Jorge and supplies water to the Santana and Faial districts, and the Rabaçal canals. The latter consist of two parallel levadas near the source of the Ribeira da Janela which were constructed in order to convey the headwaters of this stream by means of separate tunnels through the central ridge to the south side of the island, for the irrigation of the parishes of Calheta, Estreito da Calheta, Prazeres, and Fajã da Ovelha. The older and upper of these two levadas has its source in the Ribeiro do Risco, whence it derives a flow of about 18 gallons a second; its tunnel is 1,400 feet long and at 3,200 feet above the sea. The second and lower levada collects its waters from the Ribeiro dos Cedros and the place known as 'the 25 Fountains'; its tunnel is 2,575 feet long and 3,000 feet above sea-level. These larger and more elaborate irrigation channels have generally been built by the Government, private enterprise not being able to afford the cost of constructing levadas in the more inaccessible places. There are numerous other levadas bringing water from the interior to the drier slopes near the sea, and it is possible to walk along most of these.

The allocation of irrigation water leads to much litigation. The division of the water is usually decided by a committee of proprietors, and on some of the main levadas by the Public Works Department. Municipal water is auctioned each year, the present holder having the first right to it at the price he was last paying, but no one may buy water in order to resell it. Normally landowners obtain a right to a part of a flow of water for so many hours a fortnight according to the size of their property.

Land-tenure. Land is held on what is called the *bemfeitoria* system, by which each holding consists of two portions. The landlord owns the bare land and the irrigation water, while all the rest (everything that has been the work of man) belongs to the tenant and is called collectively *bemfeitorias*. With the exception of houses, the tenant may construct what he wishes and cannot be ejected without full compensation, the amount being fixed by official arbitrators. By law the produce of the land should be divided equally between tenant and landlord, but in practice the landlord usually receives only on the chief produce (grapes or sugar-cane) and forgoes, or cannot easily establish, his claim upon minor crops such as grass and vegetables. The tenant does the cultivating and harvesting and is supposed to keep all work in repair. He may will or dispose of the *bemfeitorias* in accordance with the ordinary law governing property since he is the absolute owner of them.

Distribution of Main Crops. Except for wine, recent statistics of the agricultural yield of Madeira are not available nor, owing to the extreme dissection of the island, is the distribution of crops capable of a more detailed analysis than that given in the zones already discussed. Generally speaking, the bulk of the produce comes from the southern coastal areas and from the north between S. Jorge and Porto da Cruz.

The grain production of Madeira is insufficient for local needs. Wheat has in some years occupied between 4,500 and 5,000 acres, but the yield rarely exceeds 12 bushels to the acre. The main wheat-growing area is in the neighbourhood of Prazeres in the west of the island. Maize, a staple food of the peasants, is grown to a small extent in the northern parts of the island. Small quantities of barley and rye are also produced, but the yields are inferior to those of wheat. For this reason the planting of pines is often more profitable and is often preferred to the cultivation of cereals. Consequently the import of essential breadstuffs continues.

The sugar-cane and vine have long rivalled each other as the mainstays of Madeiran agriculture. Sugar was introduced about 1425, and by the close of the century 120 mills were at work in the island, which became through this crop alone a prominent centre of commerce. In 1522 the sugar industry was giving employment to about 2,700 slaves, but about this time the export trade began to decline owing to competition from the Canaries, Brazil, and a few other countries. The crop remained predominant in Madeira until the abolition of slavery in Portugal in 1773. The wine trade then took first place and the acreage under sugar dropped very low until the middle of the nineteenth century, when a disease attacked the vines and indirectly caused a considerable replanting of sugar-cane. In the early twentieth century sugar-cane was planted on much land formerly devoted to vegetables, and in some years 1,000 tons of sugar were exported to Portugal. The type of cane commonly grown to-day is derived from Natal stock and yields from 10 to 13 per cent. of sugar. At present probably 4,000 acres are under sugar-cane. Crushing begins in March, the canes being taken, usually on bullock-drawn sledges, to the two refineries at Funchal. The British-owned factory at the capital is an up-to-date concern capable of producing 4,000 tons of granulated sugar a year, which output is sufficient to supply local needs and to provide a surplus for export. Export prices are controlled by very complicated fiscal regulations.

The vine was introduced into Madeira before the close of the

fifteenth century, the original stocks coming, it is said, from Malmsey or Malavesi in Crete. The grape was first cultivated on an extensive scale in the following century and continued to spread until the years 1788 to 1828, when about 12,000 pipes¹ were being shipped on an average annually. The trade owed much to the British, who especially in the eighteenth century greatly improved the methods of production and popularized the wine in Britain and in every English-speaking community. During the period 1846 to 1852 the vineyards were devastated by a fungus disease (*Oïdium Tuckeri*), and within the next five years shipments dropped below 1,000 pipes. The revival was slow and was retarded by the appearance, between 1873 and 1883, of phylloxera. After 1884 a hardier species of vine was introduced, with the result that since that date exports have averaged over 5,000 pipes a year. To-day the best wines are still made from the old grape budded on to American stock.

The most productive vineyards are in the south of Madeira, although the vine also grows well on the northern hill-slopes near Seixal and S. Vicente. The most favourable soils consist of a mixture of red and yellow tufa or of a kind of decomposed basalt (*cascalho*). The area under vines is computed at between 4,200 and 5,000 acres; the official statistics from 1926 to 1935 give an annual production of 12,000 to 22,000 pipes (average about 15,000 pipes), of which between 5,000 pipes and 9,000 pipes were exported annually. It is thought, however, that these statistics may somewhat overstate the actual production. Of the total yield in any one year about 50 per cent. comes from the vineyards near Funchal and Câmara de Lobos, while a further 20 per cent. is grown near S. Vicente and Porto Moniz. Large quantities of wine, chiefly in a new condition, are consumed by the islanders themselves; there is also a considerable production of table-grapes, which are grown mainly above 1,500 feet.

At the present time there are several varieties of Madeira wine, heavy and light, sweet and dry. Some of the qualities are mellowed by keeping in vats at a fixed heat before being fortified; all exported wine is, by decree, over 5 years old. The finest of the seasoned dessert wines are a rich golden-brown in colour and taste very much like an old Spanish sherry. The chief qualities exported are Malmsey, which has the character of a fine liqueur; Bual, a rich luscious wine with a delicate flavour; Sercial, a dry light-coloured wine of excellent bouquet and, in old age, of a nutty flavour; Tinta, which is largely

¹ 1 pipe consists of 92 imperial gallons.

made from black grapes, is somewhat astringent in flavour, and subsides with increasing age into the colour of a deep Madeira; and Verdelho, a rich wine abounding in saccharine, which forty years ago was the mainstay of the trade but to-day is little made.

In addition to the grape, a wide variety of other fruits and of vegetables is produced for home consumption and to some extent for export. Bananas (7,500 tons exported in 1939), dates, and pine-apples are among the main fruits. The orange, lemon, fig, guava, mango, and loquat are grown at middle altitudes, while the walnuts of the S. Vicente valley and the cherries of Serra de Agua are typical of the higher fruit zone.

Vegetables are grown by the peasants on small holdings and in the vineyards during winter when the vintage is finished. Among the commonest vegetables are the yam, potato, and sweet potato, the latter yielding three or four crops a year. A few thousand tons of 'early' potatoes are exported in most years. The pumpkin is also a staple food and its vine is trained over the huts of the peasants; *pepinella*, a variety of cucumber, is also common, being in season during the winter months. Turnip and carrot are in season all the year, while cabbage and onion produce several crops annually. Over 2,000 tons of onions and nearly 1,200 tons of other vegetables were exported in 1939. The chief leguminous cultivations are the French bean, lentil, chick-pea, lupine, and haricot bean, the last named being an important article of diet for the country folk, who eat it daily in the form of soup.

Forestry in Madeira is usually part and parcel of agriculture (p. 46), the chief crops being the cluster pine, which is planted intensively over large areas for use as pine-props and fuel, and the osier, which grows freely on the banks of watercourses.

Livestock. The official return of livestock in Madeira (including Porto Santo) in 1935 was as follows:

Cattle	.	.	.	.	.	22,874
Sheep	.	.	.	.	.	9,397
Goats	.	.	.	.	.	13,697
Pigs	.	.	.	.	.	14,106
Horses	.	.	.	.	.	62
Mules and donkeys	.	.	.	.	.	268

Cattle-breeding has never flourished on Madeira, apparently because the water contains too little lime for the health of calves. Cattle graze in the natural woodlands and on the higher slopes. The centre of the island is almost entirely surrounded by a stone wall or

fence and the pasture inside this enclosure belongs as a rule to the adjacent *concelho*. The chief stock-raising centre is Prazeres in the west of Madeira. The beef produced is good, the best being geranium fed, but the cattle are poor milkers, probably due to the lack of rich pastures. Nevertheless the dairy industry is considerable, as may be seen from the 1939 statistics, which show a production of 840 tons of butter (63 tons exported) and of 23 tons of cheese. Goats' milk is drunk by all the natives. Pigs are common, being the pet of the poor peasant and usually forming the principal dish on festive occasions. The leaves of the sweet-potato are fed in large quantities to pigs. There are a few flocks of sheep especially on the hills above Funchal, but these are kept mainly for wool, their mutton being little esteemed. The few hundred mules and donkeys are used as pack animals, as distinct from haulage which is mainly done by oxen.

Various domestic fowl are popular in the island, there being all told a few hundred geese and turkeys, a few thousand pigeons, and over 100,000 chicken. Ducks and geese waddle about in the *ribeiros*; chickens roost in the cottages of the poor townsfolk at night, and by day are tethered near the highway by a string tied to one leg and attached at the other end to a stake driven into a crevice in the cobble pavement. Turkeys are not much kept in the towns, but are driven thither in flocks in the early morning. They are offered for sale by their drivers, who, having accepted an offer of purchase of a selected bird, promptly catches the victim, wrings its neck, and hands it over to the buyer. The cavalcade then proceeds on its way.

Fishing. Eels, the only freshwater fish in Madeira, abound in the mountain streams and make good eating. About 250 varieties of marine fish, mostly European, are caught off the coasts of the island. The poorer natives of the coastal districts live largely off fish, and fishing provides an important occupation in many of the sea-side towns and villages. The best table-species caught are John-dory, sea-bream, *cherná* (a kind of cod), sardine, mullet, tunny, and white-bait. The beefy-red flesh of tunny is the chief sea-food, the fish often weighing between 300 and 600 lb.; it is caught by line about 6 miles off shore, and much of the catch is taken to a cannery at Porto da Cruz. The whitebait is much relished; it is usually caught after rains when it comes inshore into the muddy water at the mouths of the streams. The espada or scabbard fish (*Lepidopus caudatus*) is also caught in large quantities off Madeira (Photo. 80). The octopus is used in soup, as also is the loggerhead turtle, which is captured when floating asleep on the surface of the water.

No recent statistics are available of the Madeiran fishing industry, but in 1934 the Madeira group and the Azores together had 7,775 fishers who were using, all told, 42 motor-vessels (totalling 386 tons) and 1,755 small rowing- or sailing-craft. It is probable that rather less than half of these people and ships were working in the Madeira group.¹ Here the chief fishing towns and villages are Funchal, Caniçal, Machico, Câmara de Lobos, and Paul do Mar, all of which are on the south coast.

Big-game fishing is possible off Madeira, especially from April to October, when *baracouta*, tunny, *dourado*, blue fish, swordfish, dolphin, and the giant ray may be caught. Ground-sharks abound off the northern coast of the island and are dangerous to swimmers. A small amount of whaling is done from Porto Moniz.

Ports

With the exception of Funchal, the ports of Madeira are mere anchorages or landing-places. On the north coast the only notable constructional work is a jetty, about 50 feet long by 10 feet wide, with stone steps cut on one side of it, at Faial. On the south coast there are three small landing jetties, one on the north-eastern side of Machico bay (Photo. 83), another at Câmara de Lobos, and another (of rock) at Ponta do Sol, but these too are only suitable for local fishing-craft. There is, however, on this coast in addition to the facilities at Funchal, a mole at Cory's coaling depot close east of Ponta da Cruz. This mole is 260 feet long, 23 feet wide, and 7 feet above high-water; it has a minimum depth alongside of 6 feet at low water and is equipped with a travelling crane and several winch conveyors.

FUNCHAL (Lat. 32° 38' N., Long. 16° 54' W. Population of *conçelho* 68,003 in 1930.)

General Description. The Baía do Funchal, the most southerly stretch of coast in Madeira, lies between Ponta do Garajão and Ponta da Cruz, about 5½ miles to the westward. The central part of this bay consists of a shingle beach inland, from which the town of Funchal has arisen. The shingle and sand stretches continuously from Forte de Santiago to the mouth of the Ribeira de S. João about 1,400 yards to the west (Fig. 37). Between the mouth of the Ribeira de S. João and the Ribeira Seca, the beach is interrupted by a bold

¹ The registered fishing community in the Funchal administrative area has numbered 3,300 people in recent years and the craft 1,682. Of these ships, only half were usually in active commission.



81. *Funchal from the west*



82. *Funchal from the east before new breakwater was built*



83. *Machico*



84. *The Mount Railway, Funchal*

bluff about 70 feet high (opposite Loo rock) and by the rocky Pontinha headland, to-day part of the port works. The suburbs of Funchal extend inland from this section of the coast, some of the main hotels being advantageously situated above the higher cliffs overlooking the bay (Photos. 81 and 82).

Funchal is the capital of the Madeira group as well as the residence of its military governor and the seat of its bishop. It is a clean town with white houses and red roofs that rise in compact masses from the water's edge; the closely built-up area extends about 500 yards inland and is overshadowed by the grey mass of Forte do Pico, the whole being set in tropical vegetation. Behind, the mountains rise fold upon fold, green here, purple there, and dotted in an ever decreasing density with villas and houses that straggle upwards singly and in clusters until the highest lie amid pinewoods and are often in the clouds. Closer inspection reveals the plantations of bananas, the green terraces of sugar-cane, and the grey stone walls that, beneath a fringe of trees, line the watercourses and roads. The main streets are built parallel with the shore or with the four small streams which cross the built-up area. These streams flow in ravines about 50 feet wide and 20 to 30 feet deep with vertical sides. In winter a fair volume of water comes pouring down their beds and lofty, massive stone-walls have had to be built to prevent disastrous floods. In summer they are mere trickles, but at this season the watercourses, with their numerous trees and bridges, and their population of washerwomen and ducks, form a very distinctive part of the town.

Architecturally there is little to attract the visitor in Funchal apart from the cathedral (1485-1514), which has an elaborately fretted ceiling of local juniper, and the convent of Santa Clara (1492), which has an interesting chapel containing the tomb of Zarco, its founder. The older parts of the town are for the most part congested, the narrow streets being cobbled. Inland from the stretch of beach just east of the Ribeira de João Gomes the ground has been laid out as public gardens (Campo do Almirante Reis). The main administrative and industrial buildings are between the Ribeira de João Gomes and the Ribeira de S. João; most of the large villas and hotels are in the western suburbs.

History. The growth of Funchal is in reality the history of Madeira. Soon after the first landing by the Portuguese a settlement was laid out on a plain covered with fennel (*funcho*) and this grew rapidly, being raised to the rank of a city in 1508 and to the seat of a bishopric in 1514. The city was plundered and partly destroyed by a French

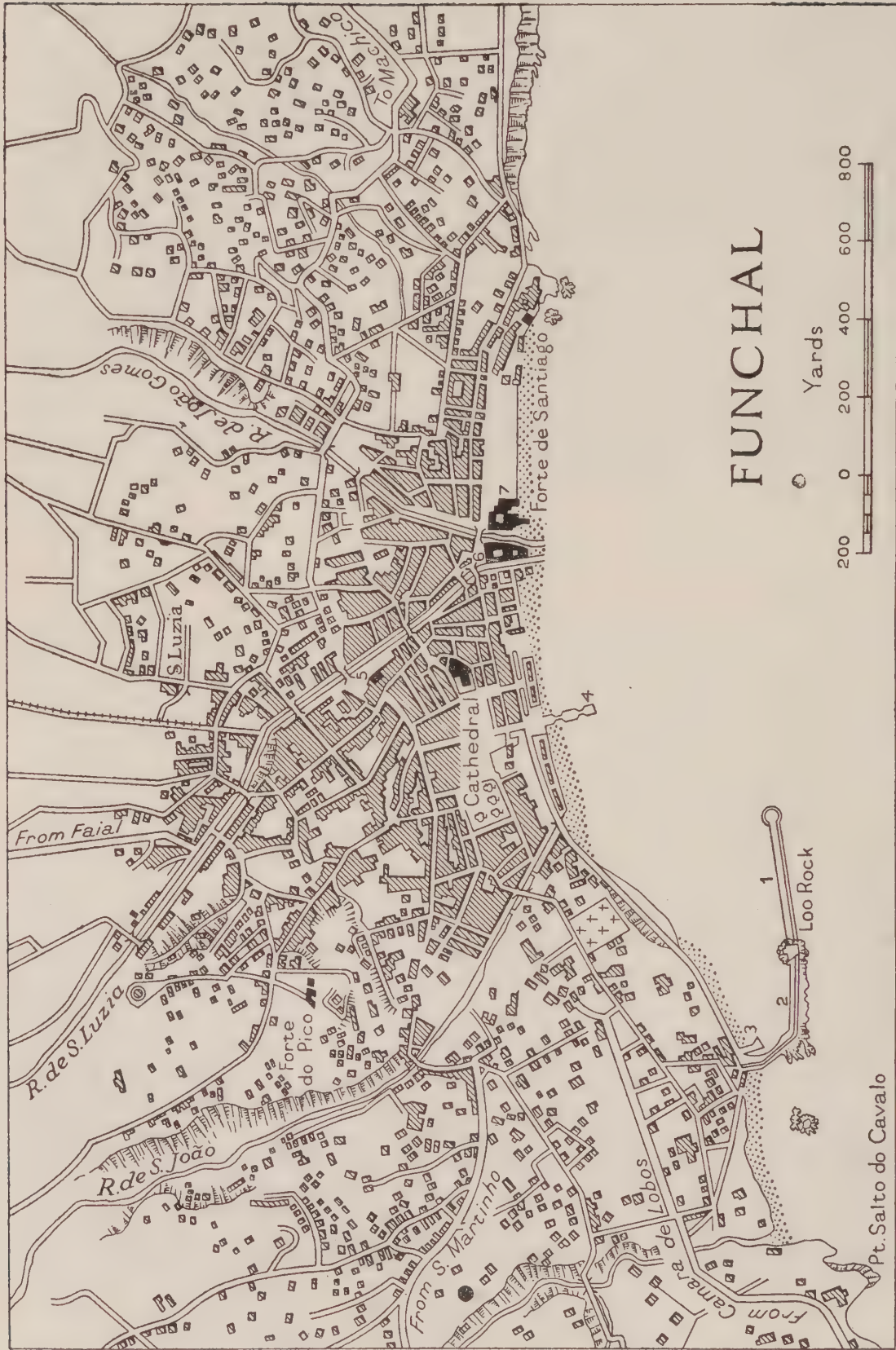


FIG. 37 Plan of Funchal

1. New breakwater. 2. Old breakwater. 3. Coal jetty. 4. Town pier. 5. Town Hall. 6. Sugar factory. 7. Electric light and power station

raiding fleet in 1566. In the seventeenth and eighteenth centuries trade with Britain began to flourish and Funchal became a favourite resort for Englishmen. A British factory was established at Funchal, and it retained a powerful position till the early nineteenth century. As the main port of Madeira, the city reflects the economic development of the island. Its coat of arms includes five sugar loaves; originally a stem of sugar-cane was disposed on each side of the shield, but this was later replaced by a vine branch with fruit. The walls of the old town (built between 1572 and 1637) were demolished about 1750, so that only a few forts, including Forte do Pico, remain of the former fortifications.

The modern growth of the city has been intimately bound up with improvements to the harbour. Up to about 1895 the port was little better than an open roadstead; then a new breakwater was built joining the Loo rock to the mainland, and the method of landing was much improved by the construction of a small pier at this breakwater. Twenty years later the harbour was still dangerous in bad weather, although a slight improvement had been made by the addition of a central stone pier for boats and launches. About 1933 the landing facilities were greatly improved by the extension of the old jetty; the new breakwater continues the line of the old with which it communicates by means of a tunnel, 250 feet long and 20 feet wide, through the Loo rock. It is probable that a further extension may be added.

Industry and Commerce. Funchal is the only industrial centre of Madeira, but its industries apart from ship-repairing (p. 247) are merely of local importance. The main factories, which include two sugar-refineries and a brewery, have already been mentioned. The city, however, derives much profit from the tourist industry, which is well catered for by several large hotels.

In 1937 the total trade of the port was 265,584 tons, the majority of the goods being imports. These trade statistics, however, give little idea of the business of the harbour. In 1934, 1,272 vessels (mechanically driven) totalling 9,500,000 tons entered the harbour; these landed 8,341 passengers, took aboard 6,886 passengers, and carried 136,113 passengers in transit. Of the total passengers concerned, 86,000 were British, 24,000 German, and nearly 20,000 Portuguese. A list of the lines of steamships calling regularly at Funchal in normal times is given on p. 102.

The main imports of the port are coal (about 100,000 tons a year), general merchandise, grain (about 20,000 tons a year), Diesel oil (for

the power station), and petrol. The chief exports are wine (7,000 to 10,000 pipes), fruit, vegetables, willow, embroidery, wickerwork, and macaroni.

Detailed Description. The harbour of Funchal consists of an open roadstead the western part of which, the Baia da Pontinha, is protected for about a quarter of a mile by a breakwater, which has a quay on its inner side. The anchorage for men-of-war lies between 400 yards and 1,000 yards south of the town pier (Fig. 37); that for ships coaling or calling is between the outer end of the breakwater and the town pier. At least 10 large merchant ships can anchor off the town and 8 medium-sized ships at buoys; 3 small ships can anchor in the Baia da Pontinha and a further 3 merchant ships alongside the breakwater quay. When winds are from a southerly quarter a heavy surf prevails and may make communication with the shore difficult except in the shelter of the breakwater; a heavy swell may also be experienced during south-westerly gales.

At the port, in addition to the breakwater quay there are a coaling jetty (in the western corner of the harbour) and a passenger pier extending southwards from the centre of the town. Cargo is discharged either alongside the breakwater quay or by lighters to the breakwater quay and to the coaling jetty. The older part of the breakwater is 4 feet above high water and the newer part 13 feet above high water. Spring tides rise 9 feet. The town pier is suitable only for passengers; it is 16 feet above high water and has two sets of steps on each of its two sides for launches and light craft. The two inshore sets of steps are only available at high water. There are a few small cranes on the breakwater and on the coaling jetty and a floating-crane in the harbour.

Further details of the wharfage are given in the following table:

	<i>Length (feet)</i>	<i>Width (feet)</i>	<i>Depth alongside (feet)</i>	<i>Berths</i>
Breakwater quay (old part)	500	40	18	1 ship up to 335 feet.
Breakwater quay (new part)	900	40	28	2, or 1 ship up to 700 feet.
Town pier	380	65	Variable	None (light craft only)
Coaling jetty	50	65	13	..

There are several tugs of 20 to 50 tons available and about three dozen motor-launches, as well as a few coal-lighters and water-lighters. There is no fuel-oil for ships.

Port Facilities. The small shipyard at Funchal lies just west of Forte de Santiago. It contains a fully equipped machine shop, a foundry, carpenters' shop, and a small stock of various repair materials. It has two capstans, one steam and one electric, but there is no slipway, ships up to 200 tons being beached or launched only after the special clearance of shingle.

There are two private slipways, made of concrete and fitted with capstans, east of the town pier.

Communications. Funchal is the hub of all the communications of Madeira, including a short funicular railway to the heights above the northern suburbs. Motorable roads lead along the south coast north-eastwards to Machico ($15\frac{1}{4}$ miles) and westwards to Ponta do Pargo (45 miles). Another motorable road traverses the central ridge and gives connexions with Faial ($19\frac{1}{4}$ miles) and Santana ($24\frac{1}{2}$ miles).

Six cables commence here, giving communication with Carcavelos (Lisbon), S. Vicente (Cape Verde islands), and Porthcurnow (Cornwall). The cable hut is situated close east of Forte de Santiago. There are two main radio stations; the one, a government concern at Forte do Pico; the other, a commercial station at Ponta do Garajão (p. 108). The town is linked by telephone to all the main villages and towns of Madeira; in Funchal itself the working at present is semi-automatic with an underground cable system.

Communications

There are no navigable rivers or canals in Madeira, although this lack is largely compensated by a considerable coastal traffic by means of small craft. Since there is only one short stretch of railway, inland transport is by road, the chief methods being by motor-cars and by ox-cart, ox-sledge, and head-porterage.

Sledges (*carros*) drawn by bullocks or mules still have a wider range than motor-cars, being able to penetrate the country along many tracks where wheeled traffic cannot pass. The carro is the only vehicle that can lay genuine claim to a home in the island. There are numerous varieties of these sledges, but the most imposing is that used as the passenger vehicle of Madeira. It has a rather graceful, boat-like body, with seats that face each other, protected by an awning above and by curtains at the side. Yoked to its massive pole by means of wooden collars are a couple of oxen, each with a leather strap hanging from a hole drilled in the horn. These straps form the guides. On the end of the pole is a metal ticket bearing the

registration number of the vehicle. This particular type of carro was designed, it is said, by an Englishman, Captain Bulkeley, in 1848. The ordinary sledge of commerce is a crude affair yet has a surprising carrying capacity; the running carro is a swifter, smaller construction well known to visitors to Funchal. Hammocks are occasionally used for carrying passengers, but riding-horses and mules are scarce. A good deal of transport is done on the shoulders and heads of the people, especially in the more mountainous districts. This particularly applies to wine, which in parts is still taken to Funchal in goat-skins on the shoulders of men porters.

Railway. The Mount railway was opened to the Mount Church (Nossa Senhora do Monte; 1,965 ft.) in 1895 and to Terreiro da Lucta (c. 3,000 ft.) in 1912. It is $2\frac{1}{2}$ miles long and the gradient varies from 1 in $6\frac{1}{2}$ to 1 in 4. The line is rack-and-pinion, and single-track with two loops for passing. The locomotives are steam-driven. The railway is controlled by the Cía. de Caminho de Ferro do Monte, which owns 4 locomotives, 4 cars each carrying 50 passengers, and 1 freight car. The railway commands magnificent views of Funchal bay and the coast adjoining it. In order to save straining the engine, the train rarely stops at some of the minor stations, passengers being expected to alight as it passes the station at a crawl (Photo. 84).

Roads. Until about 1910 the only carriage road in Madeira was the *Estrada Monumental* from Funchal to Câmara de Lobos ($5\frac{1}{2}$ miles). All other roads were unsuitable for wheeled traffic, partly because of the corduroy pavement, consisting of carefully laid cobbles or small stones, and partly because of the extreme gradients, down which even sledges drawn by oxen proceeded slowly. Soon after 1910 it was realized that a few alterations of the steepest corners of the roads and a little adaptation of their surface would make many of the routes suitable for motor-traffic. Since that time there has been a considerable extension of the motorable roads which still proceeds actively, although the expense of paving is so great that only stretches of a few hundred yards are put up for contract at a time, according to the funds available for the purpose.

The present network of motorable roads consists mainly of a road along the south-coast from Machico to Ponta do Pargo, and of two trans-island routes, the one from Ribeira Brava to S. Vicente, the other from Funchal to Santana (Fig. 38). There are in addition a few roads inland from Machico, the semblance of a network inland from Funchal, and a few short stretches to or towards those parts of

the central ridge most visited by tourists. The rest of the island is well served by tracks which are impassable to wheeled traffic as they are often stepped.

The automobile registration of Madeira in 1940 comprised 1,231 automobiles of all kinds, of which about 600 were passenger cars for hire. The number of cars is increasing steadily somewhat in proportion to the mileage of motorable roads. Most of the motorable routes have omnibus services. Late in 1941 the main length of track being converted to a motorable condition ran from Ponta do Pargo to Porto Moniz and thence, linking up with several completed stretches, along the north coastal slopes to Porto da Cruz and Portela, thereby completing the circuit of the island (c. 130 miles). It was thought that several stretches of these reconstructions would be finished within another twelve or eighteen months. One of the earliest stretches to be completed will be that from Porto da Cruz through S. Roque to Cruzinhas (3 miles).

The motorable roads of Madeira are mostly stone-paved, although some sections which are engineered and wide enough for motors still await paving. The reconstructed roads are in a good condition, the two trans-island roads being the best. The average width is 20 feet and the load capacity up to 5 tons. The dissected nature of the country necessitates the construction of numerous bridges (mostly of stone) and many cuttings; corniche roads are common and tunnels not infrequent, while the abrupt relief causes an abundance of sharp bends and of gradients of 1 in 7 and over. The main topographical features crossed by these motor roads are discussed in the following itineraries.

Funchal-Ponta do Pargo-Porto Moniz

Late in 1941 this road, the main south coast route west of Funchal, was stone paved to Ribeira Brava, unpaved thence to Ponta do Pargo, and under construction thence to Porto Moniz. Throughout its length sharp turns, hairpin bends, steep gradients, and cuttings in cliffs and hill-sides are common (Fig. 38).

After leaving the centre of Funchal the road crosses the Ribeira Seca (bridge 270 ft. long; 30 ft. wide, 100 ft. above stream-bed) and proceeds along the Estrada Monumental, passing close to the cliffs near Reid's Hotel. Westwards, it winds along the coast, taking a fairly flat course within a few hundred yards of the cliff-top as far as Praia Formosa (3 miles). Beyond this beach the cliff-top is followed except for a deviation inland around the mouth of a small

ravine. A long bridge close to the shore at the mouth of the Ribeira dos Socorridos precedes the fishing-town of Câmara de Lobos ($5\frac{1}{2}$ miles).

Beyond the town the road climbs inland winding through open, highly cultivated country. The gradient occasionally reaches 1 in 7, but the surface is well constructed and carefully graded. At Estreito de Câmara de Lobos ($8\frac{1}{2}$ miles; *c.* 1,300 ft.) the route turns westwards and, keeping mainly at 1,000 feet to 1,300 feet, threads its way around high mountain spurs and up and down the sides of deep ravines to well beyond Campanario (13 miles). Within a mile of Ribeira Brava ($15\frac{1}{2}$ miles) the road descends almost to the top of the cliffs, between 400 feet and 700 feet, above the sea, and then makes a fairly sharp descent, with several bends, into the town itself.

Having crossed the floor of the Ribeira Brava ravine, the route ascends, with several hairpin bends and gradients of 1 in 7, the steep western side of the valley. Much of the route hence to Ponta do Sol ($20\frac{1}{4}$ miles) is cut in the mountain side and is dominated by steep terraced slopes in parts forested with pine. The journey is circuitous and, although confined to altitudes of about 650 feet, includes a steep ascent up the side of the Ribeira da Tabua ravine and another sharp gradient 1 mile east of Ponta do Sol. This small township lies 400 yards south of the main road, to which it is joined by a motorable branch-road.

The coastal artery west of Ponta do Sol has to cross several abrupt-sided ravines, the negotiation of which causes several steep gradients and numerous hairpin bends. As a rule the route keeps to the cultivated hill-sides at a height of 800 to 1,500 feet; it passes within a few hundred yards of the cliffs when rounding spurs, but diverges a mile or so inland up the larger ravines. Consequently the small sea-side villages at the mouths of the streams are some distance south of the road. Madalena do Mar (24 miles) is served by a path half a mile long and Calheta ($29\frac{1}{2}$ miles) by a track 1 mile long.

A short distance beyond the junction of the track to Calheta and the main coastal route, a motorable branch-road leads north-north-eastwards up a mountain spur and climbs to about 3,000 feet in $2\frac{1}{4}$ miles. From the head of this road several tracks lead to the moorlands of the main ridge, while another follows a flat levada to a long tunnel which penetrates the main ridge and so give access to the fountains and rest houses at Rabaçal (3,100 ft.).

West of the neighbourhood of Calheta the south coast route keeps at least $1\frac{1}{4}$ miles inland in order to avoid the precipitous coastal slopes. The road actually passes through Prazeres ($35\frac{3}{4}$ miles), which stands amidst almost typical English scenery, but does not go within three-quarters of a mile of Fajã da Ovelha ($40\frac{3}{4}$ miles). The next section of the route, to Ponta do Pargo (45 miles), is mostly at 1,500 feet to 2,000 feet and its surface is occasionally heavy with dust in summer and slippery during rain in winter. Late in 1941, motor-traffic was not able to proceed safely far beyond Ponta do Pargo.

Here the road turns north-eastwards to Achadas da Cruz ($50\frac{1}{2}$ miles) and Porto Moniz ($56\frac{1}{4}$ miles), a difficult journey which lies for the most part at altitudes of 1,500 feet to 2,500 feet. The road surface in 1941 was of red earth. Of several sharp gradients, that descending to Porto Moniz is especially steep and commands a wide view seawards. It is proposed to construct a motorable road from Porto Moniz along the north coast to S. Vicente, where the coastal track has already been made suitable for motor traffic.

Funchal-S. Cruz-Machico-Portela

This road, the south coast route east of Funchal, is $21\frac{3}{4}$ miles long and is stone-paved and motorable throughout its length. It is 20 feet wide to Machico and 24 feet wide thence to Portela. Although the distance is short there are two long bridges, many shorter bridges of 10 to 20 yards length, and frequent culverts (Fig. 38).

After leaving the eastern suburbs of Funchal the road makes a gradual, winding ascent (occasionally at 1 in 9) around several mountain spurs and ravines. At $2\frac{1}{2}$ miles it turns seawards to the edge of the cliff, where it is confined for a short way between the cliff-top, here 600 feet high, and the precipitous mountain slopes. Eastwards the road climbs gradually to 1,160 feet before descending slightly to Caniço ($4\frac{3}{4}$ miles). Thence a fairly level course over terraced hill-sides is followed to the neighbourhood of Porto Novo ($8\frac{1}{2}$ miles), where there is a steep descent and ascent (up to 1 in 7) of the sides of a ravine. The bridge across the stream here is a long structure with approaches that have been cut into the precipitous flanks of the ravine.

The route now turns northwards along the lower hill-slopes at 200 feet to 300 feet altitude, and within $1\frac{1}{2}$ miles begins to descend to S. Cruz ($11\frac{1}{2}$ miles). The approach to the town is over a bridge 200 feet long and 12 feet wide. Beyond S. Cruz the road climbs to the cliff-top and is joined by a road from S. Antonio da Serra. The

coastal route follows the cliff-top, with many stretches of cornice, through rather barren country to Machico ($15\frac{1}{4}$ miles). From Machico there is a motorable road 2 miles long to Ribeira Seca, whence a track, at present unfit for bicycles, leads to Porto da Cruz.

The main route inland from the town traverses the western side of the small plain at the head of the bay and then turns north-westwards climbing obliquely up the wooded western slopes of a wide valley. The route ascends, with an average gradient of 1 in 15 and occasional gradients of 1 in 10, all the way to the head of the valley at Portela ($21\frac{3}{4}$ miles; altitude 2,000 ft.).

From this pass a motor-road is under construction to the north coast at Porto da Cruz, but late in 1941 the necessary bridges had not been completed.

Funchal-Poiso-Faial-Santana

This is the only motor route connecting Funchal with the rich agricultural lands near Faial and Santana. It is $24\frac{1}{2}$ miles long and 24 feet wide; stone-paved to Cruzinhas, earth-surfaced thence to Faial, and stone-paved from Faial to Santana; it is motorable throughout its length. It is a true mountain road with many bridges, numerous steep gradients, many hairpin bends and, for much of its course, hemmed in by abrupt mountain slopes (Fig. 38).

The road begins in the northern suburbs of Funchal and takes a fairly steep, tortuous course, often cut in the sides of wooded hill-slopes, to the Mount (c. 1,915 ft.). Northwards the ascent continues and becomes appreciable (1 in 9) at the crossing of the ravine of the Ribeira das Cales (2 miles from Poiso), where there is a bridge 75 feet long and 18 feet wide. A stretch of flatter, more open country precedes Poiso ($8\frac{3}{4}$ miles; 4,553 ft.).

Beyond the pass, a sharp descent (up to 1 in 6) with an acute double-bend leads over open country to the wooded ravine of the Ribeiro Frio, which is bridged for the first time at 2,901 feet. The road proceeds northwards in this valley until, with the aid of a great hairpin bend, it enters the ravine of the Ribeira da Metade (bridge 20 ft. long; altitude 1,033 ft.). Beyond Cruzinhas (15 miles) the road, of earth-surface in 1941, follows a wooded mountain spur to within half a mile of Faial ($19\frac{1}{4}$ miles). Just before entering this large agricultural village the road makes a sharp descent down the edge of a ravine and crosses the Ribeira Seca by a bridge 100 feet long and 12 feet wide.

From Faial (c. 650 ft. altitude) the route climbs fairly steeply to nearly 1,700 feet and then traverses an undulating, fertile countryside to Santana ($24\frac{1}{2}$ miles; altitude 1,400 ft.).

Ribeira Brava-S. Vicente-Ponta Delgada

The only other motor-route across Madeira runs from Ribeira Brava to S. Vicente on the north coast. Although it ascends the deepest and narrowest valley of the south coast, the road is one of the best in the island and is stone-paved throughout its length (Fig. 38).

From Ribeira Brava the route proceeds up the east side of the narrow but flat floor of the valley and crosses the stream about three-quarters of a mile north of the town. Thence it follows the west bank and keeps a fairly level course at the foot of abrupt slopes to Serra de Agua ($4\frac{1}{2}$ miles). The route now climbs steeply (over 1 in 7 in parts) and with the aid of numerous acute bends and of several bridges up the valley-sides of the headstreams of the river. This difficult ascent leads to the high open mountain summits east of the Pico do Cedro, the divide being crossed at the Encumeada pass (7 miles; altitude 3,430 ft.).

Beyond the summit the road descends steeply (1 in 7) for about $4\frac{1}{2}$ miles with many windings and sharp bends through a forested country. Within 2 miles of S. Vicente ($13\frac{1}{2}$ miles) the gradient becomes gentle and much of the land is under cultivation.

From S. Vicente the road continues to be motorable as far east as Ponta Delgada ($18\frac{1}{2}$ miles). The first serious obstacle is the Ribeira de S. Vicente, which is crossed at its mouth by a long bridge. Thence, for the most part, the route is closely confined between the sea and the cliffs, through which it tunnels in several places. It is free from steep gradients except at one point 3 miles east of S. Vicente.

Poiso-S. Antonio da Serra-S. Cruz

The only stretch of motorable road along the central ridge of Madeira is that from Poiso to S. Antonio da Serra. This route is connected with the Machico-Portela road and to the main road along the south coast (Fig. 38).

At Poiso (4,553 ft.) the north-to-south Funchal-Faial motor-road is crossed by an east-to-west route. The latter route west of Poiso is motorable for just over 2 miles, beyond which, having climbed to 5,000 feet, it deteriorates into a track leading to the Pico do Arieiro. East of Poiso the road to S. Antonio da Serra is narrow and

unmetalled yet, in spite of its indifferent surface, it is said to be motorable. The first stretch of the journey lies through pinewoods which are succeeded by several miles of high, open moorland (altitude 2,600 ft. to 4,200 ft.). The steepest gradient (1 in 7) occurs 2 miles east of Poiso. Pinewoods are entered again within 2 miles of S. Antonio da Serra (6 miles).

At S. Antonio the road forks; one branch (stone-paved and 24 feet wide) continues eastwards making a winding descent about a mile long to the Machico-Portela route; the other branch, also stone-paved and usually 24 feet wide, turns south-eastwards to the south coast. The latter road traverses for about $1\frac{1}{2}$ miles the grassy flat-topped upland at an altitude of over 2,000 feet above sea-level. It then makes a fairly gradual descent to the neighbourhood of Agua de Pena (9 miles), whence it drops sharply (1 in 7) with the aid of several acute bends to the south coast road about 1 mile east of S. Cruz (12 miles).

Motor Routes near Funchal

Several short stretches of motorable road, used by motor buses, have been built near Funchal to connect the city with the main villages and chief view-points in its neighbourhood. On the west side of the city roads run to S. Antonio (950 ft.), S. Martinho (764 ft.), and S. Roque (1,130 ft.); the Grande Curral may also be reached by motor-car by a new road running via S. Antonio, Buliqueime, and the valley of the Ribeira da Lapa. From the head of this road, which is on the lip of the outer Curral, a chasm 2,000 feet deep, a short walk brings visitors to a viewpoint overlooking the Grande Curral.

East of Funchal three motorable roads traverse the hill-slopes and join near Palheiro before proceeding to Camacha ($5\frac{3}{4}$ miles), a favourite summer resort. The motor-road turns south-eastwards about half a mile before it reaches the centre of the village and descends, with fairly steep gradients and several sharp bends, to the main south coast artery $1\frac{1}{2}$ miles east of Caniço (10 miles). This section of the route, from Camacha to Caniço, is unpaved, but will take wheeled traffic up to 5 tons in weight.

PORTO SANTO

PHYSICAL GEOGRAPHY

PORTO SANTO lies 26 miles north-east of Madeira and about 40 miles from Funchal. It is 7 miles long from north-east to south-west and has a mean breadth of $2\frac{1}{2}$ miles and a maximum breadth of 4 miles. The island is about 19 miles in circumference and covers an area of nearly 20 square miles (Fig. 39).

Relief

Porto Santo is of volcanic origin, but unlike the island of Madeira, the surface of its lower areas consists mainly of sand interspersed with much rock and broken shells.

All the north-eastern part of Porto Santo is occupied by a hill-mass with cone-shaped peaks, several of which exceed 1,300 feet and the highest of which (Pico do Facho) reaches 1,693 feet. The slopes of the main hills are dissected by small valleys diverging from Pico do Facho and Pico do Castelo. The outlets of these rivulets form the only breaks in the high precipitous coast, which in places exceeds 1,000 feet and even 1,400 feet within a few hundred yards of the shore.

The central part of Porto Santo is a low-lying, sandy plain that slopes gradually southwards from about 300 feet at the cliffs of the north coast to a low sandy beach on the south side of the island. The land near this beach is seldom more than 150 feet above sea-level.

The western and south-western parts of Porto Santo are hilly and rocky, although the main hills are only 750 feet to 930 feet high. The highest peaks are in the west, where they drop to the coast in precipitous cliffs. Eastwards the land declines to a narrow coastal plain, consisting mostly of fine, yellow sand (Photos. 85 and 87).

The Ilhéu de Baixo, which lies a short distance off Ponta da Calheta, is a tabular islet with an average elevation of 200 feet and a summit height of 587 feet, and is formed largely of a deposit of coral limestone.

Water-supply and Vegetation

The rainfall of Porto Santo is much the same as that of the lower areas of Madeira, but irrigation is more difficult and the streams dry up more quickly because of the sandy, calcareous nature of the soil.

Drinking-water is scarce, the main supply coming from five small springs of pure water and a few wells. One of the springs is close to the shore in a sheltered cove due west of Espigao hill in the south-

Main Roads.....
Heights in Metres



FIG. 39. *Porto Santo*

Relief shown by contours at 100-metre intervals

west of the island. There are in addition one or two springs charged with carbonate of soda, the water of which is bottled and sent to Madeira. The streams on the island are insignificant, all being dry for most of the year, and many never reaching the sea at any season.

Dragon-trees were once plentiful on Porto Santo, but now trees and timber are scarce, there being very little natural vegetation and not

much verdure of any kind. The main pine-woods are on the upper slopes of Pico do Castelo and, to a smaller extent, on the northern slopes of Pico Juliana. There is a little scrubland on the headland adjoining Pico Branco, but all the centre and west of the island is virtually bare of timber, and much resembles a part of the Moroccan coast.

Coasts

The coasts of Porto Santo are about 20 miles long and are steep and inaccessible except in the south-east. The western, northern, and eastern coasts between Ponta Canavieira and Pedra Rachada (opposite



FIG. 40. *Porto Santo from the north-west*

the Ilhéu de Cima) stretch for about $12\frac{1}{2}$ miles, and are formed of abrupt cliffs, with many off-lying rocks and several islets. The outstanding headlands from west to east are Ponta Canavieira, near which are cliffs about 500 feet high; Ponta dos Varadouros; Ponta da Cruz, the northern point of the island; Ponta de Nordeste, the seaward termination of Pico Branco (1,500 ft.); Ponta dos Ferreiros; and Pedra Rachada. The rocky islet of Ferro, which lies 600 yards west of Ponta Canavieira, is 380 feet high and is surrounded by steep cliffs; Fonte da Areia islet, which lies 1 mile off the north-west coast, is a black, basalt rock, 270 feet high and steep-to; northwards of Ponta de Nordeste are three islets, Cenouras, 360 feet high and covered with scrub, Meio, consisting of a group of low rocks, and Fora, thickly wooded with a peak 330 feet high (Fig. 40); 400 yards off Pedra Rachada is Cima islet, which is generally flat topped, except in the south-east (360 ft. altitude), and is noteworthy for its lighthouse and a small cove on its north-eastern side where landing is possible in good weather.

The Bahia de Porto Santo, about 6 miles long, is cliffed in the east, but a wide sandy beach extends for about 4 miles to Ponta da Calheta. The beach is the finest in the whole of the Madeiran archipelago. Behind it, sandy cultivated country slopes gradually to 300 feet in the central area and more abruptly to between 600 feet and 900 feet in the south. The usual landing-place is in front of the small town of Vila Baleira, which is the only important settlement in the island. A poor

road runs parallel with the beach from Vila Baleira to Ponta da Calheta, and there are several tracks leading inland from it.

The high, precipitous coast between Ponta da Calheta and Ponta Canavieira faces the steep cliffs of Baixo island, where the only landing-place is in a cove in the north-west.

HUMAN GEOGRAPHY

Distribution of Population

In 1930 the population of Porto Santo was 2,490 persons, or about 130 to the square mile. The population is remarkably stationary, and the number of inhabitants has not increased by more than a few hundred in the last twenty years.

Most of these people dwell in or near Vila Baleira, which is the only town. Elsewhere there are a few scattered dwellings in the main valleys of the north-eastern hill-mass, and a few small hamlets in the vine-growing country near Camacha, Campo de Cima, and Espírito Santo. The higher parts of the island and all the hill-slopes overlooking the eastern, northern, and western coasts are practically uninhabited (Fig. 39).

Vila Baleira (or Porto Santo), the capital of the *concelho*, has between 1,800 and 2,000 inhabitants. It consists of a cluster of houses and a church, set close to the shore at the mouth of the seasonal Ribeira da Vila. The lower houses are actually on the sands and sand-dunes near the shore; the rest stand on the seaward slopes of a small plain that is surrounded by a semicircle of low conical hills, 120 feet to 190 feet high. The town in the past suffered frequently from raids by English and French privateers. Christopher Columbus, who married the daughter of Perestrello, the Governor of Porto Santo, lived here for some time in a house which still stands next to the small church. On this account, and because of its dry climate and fine bathing-beaches, Vila Baleira is much visited by tourists from Madeira during the summer months (Photos. 86 and 88).

Industries

The main industries of Porto Santo island are agriculture and fishing. In addition, a few people are occupied in the making of embroidery, in the manufacture of cement (one small factory at Vila Baleira), in the bottling of mineral water, and the quarrying of limestone. The mineral water, which is derived from one or two springs charged with carbonate of soda, is bottled and exported in consider-



85. *Porto Santo from Baixo*



86. *Vila Baleira from the north-east with Baixo in background*



87. *Porto Santo from the east*



88. *Vila Baleira, Porto Santo*

able quantities to Madeira, where it is much esteemed as a table-water. The limestone quarries are on Baixo island. They are worked in horizontal galleries by a crew of diggers, some of whom live in cliff-dwellings in the rock. The workmen carry the stone in containers balanced on the neck and head, and climb down 300 feet of winding cliff path to load the cargo boats which take the limestone to Madeira, where it is burned into lime for general use.

The agriculture consists mainly of the cultivation of the vine, maize, barley, and a few other food plants, including the melon. When the scanty, irregular rainfall suffices, good harvests of grapes and maize are gathered, but long periods of aridity are common, and even in the best years most of the vegetables and foodstuffs consumed on the island are imported from Funchal.

In spite of the shortage of rainfall and of irrigation water, vines are grown on a considerable scale, and the island yields annually about 600 pipes of excellent wine. The main vineyards are on the plains and lower slopes of the central part of Porto Santo, west of Camacha and north-west of Vila Baleira. Vines are also grown less intensively in scattered areas west of Espírito Santo and on the slopes overlooking the sandy beach on the south-east side of the island. The vines are trained near the ground, the bunches of white grapes often lying on the hot sand. In this way the grapes are almost toasted by the sun and the heat of the sand, and consequently mature to a much greater degree than in Madeira, and acquire a higher natural alcoholic content. The gathering of the grapes usually begins about the middle of August, and includes special varieties for table use.

Barley and maize are grown in small quantities in the lower areas of Porto Santo, the meal of maize with fish being the staple food of the people. There is little feed for stock, but a few cattle and plenty of goats (for milk) are kept, as well as a considerable number of chicken.

The tourist and fishing industries of Porto Santo resemble, on a small scale, those of Madeira. The tourist industry mainly benefits Vila Baleira, which is visited each summer by between 300 and 400 Madeiran residents, Portuguese and English, who often spend two or three weeks here, the dry air (and fine bathing) being a relief from the more humid atmosphere of Funchal.

Port and Communications

The only anchorage off Porto Santo is in 16 fathoms of water in front of Vila Baleira. The harbour is merely an open roadstead, which is satisfactory in settled weather but is very rough during strong

southerly winds. A small pier (Ponte Cais) projects from the beach in front of the town, being a direct continuation of the main street leading to the church and the town-hall (Photo. 86).

Regular trips are made by coastal steamer from Funchal to Vila Baleira usually once a month and sometimes more often in summer, the journey taking 5 or 6 hours. Coaling-boats also make fairly regular journeys between the two ports. As landing is made on the beach at Vila Baleira by small boats, the service is liable to interruption by bad surf conditions. In addition, steamers plying between Lisbon, Madeira, and the Azores sometimes call at Porto Santo to land and embark passengers.

The roads of the island are short and for the most part in poor condition. Outside the main streets of Vila Baleira there are a few stretches of improved road (*estrada municipal*). One of these leads south-westwards along the beach for a short distance only before it deteriorates into an unimproved road and, as such, continues almost to Ponta da Calheta; another stretches for 1 mile inland from Vila Baleira, whence it continues as an unimproved road to the main hamlets of the central part of the island; the other stretch of improved road runs from Vila Baleira eastwards for three-quarters of a mile to the foot of the cliffs at the eastern end of the beach. The higher and more rugged parts of the south-west and north-east of the island are almost devoid of tracks. Porto Santo has no submarine cables, nor is there any telephone or telegraph service. Apart from shipping, the only connexion with Madeira is by radio, there being a station at Vila Baleira, which is owned by the Portuguese Government but is open to public correspondence (p. 349).



89. *Deserta Grande from Chão*



90. *Selvagem Grande from the south-west*



91. *Portuguese cargo vessel (S.S. Butio) lying off Selvagem Grande*



92. *Enseada das Cagarras, Selvagem Grande*

THE DESERTAS

THE Desertas islands lie about 10 miles south-south-east of the eastern extremity of Madeira and are visible from Funchal. They consist of three small islands, Chão, Deserta Grande, and Bugio, which together form a narrow chain about 14 miles long (Fig. 41).

Chão, the northernmost and smallest of the group, is about a mile long and a quarter of a mile wide at its northern extremity. Its bare flat surface rises to a height of about 340 feet. The southern end terminates in a narrow point from which rocks extend, thus leaving only a boat passage between Chão and Ponta da Castanheira, the northern extremity of Deserta Grande. Chão is surrounded by high cliffs with a number of outlying rocks including the Sail rock (Farilhão Testa), a basaltic column about 160 feet in height (Fig. 42). The best landing-place is at a cove on the west coast, from which there is a climb of about 300 feet to the long narrow plateau that forms the summit of the island.

To the south of the narrow strait of Boqueirão Norte is Deserta Grande, 7 miles long and 1 mile broad at Ponta do Pedregal, its widest part (Photo. 89). This island is the largest and most elevated of the group. From the plateau in the interior which reaches a height of about 1,450 feet a continuous rocky chain runs to the southern extremity of the island. North of the plateau there is a double ridge with an extensive valley between. Both the eastern and western coasts of the island consist of high broken cliffs. The best landing is at Ponta dos Pargos, a small cove on the western side of the island, about half a mile northward of Ponta do Pedregal.

Bugio, the southernmost island, is separated from Deserta Grande by a deep and clear channel about three-quarters of a mile wide. This island is 4 miles long and nowhere more than half a mile wide. A serrated ridge follows the whole length of the island but sinks halfway (opposite Baia do Marechal) to a well-marked depression so that from a distance Bugio has the appearance of two islands; the northern part rises to 1,142 feet at Amarelo hill and the southern to nearly 1,700 feet at Quartos hill. The crest of the ridge is often covered in mist, that encourages a growth of grass, bracken, and gorse, except where the wind has left a desert of drifting sand. The coasts of the island consist of rocky cliffs that are not so high as those of Deserta Grande.

The three islands are generally bare of vegetation. Deserta Grande has some good grassland and a few scattered pine-trees. The group is

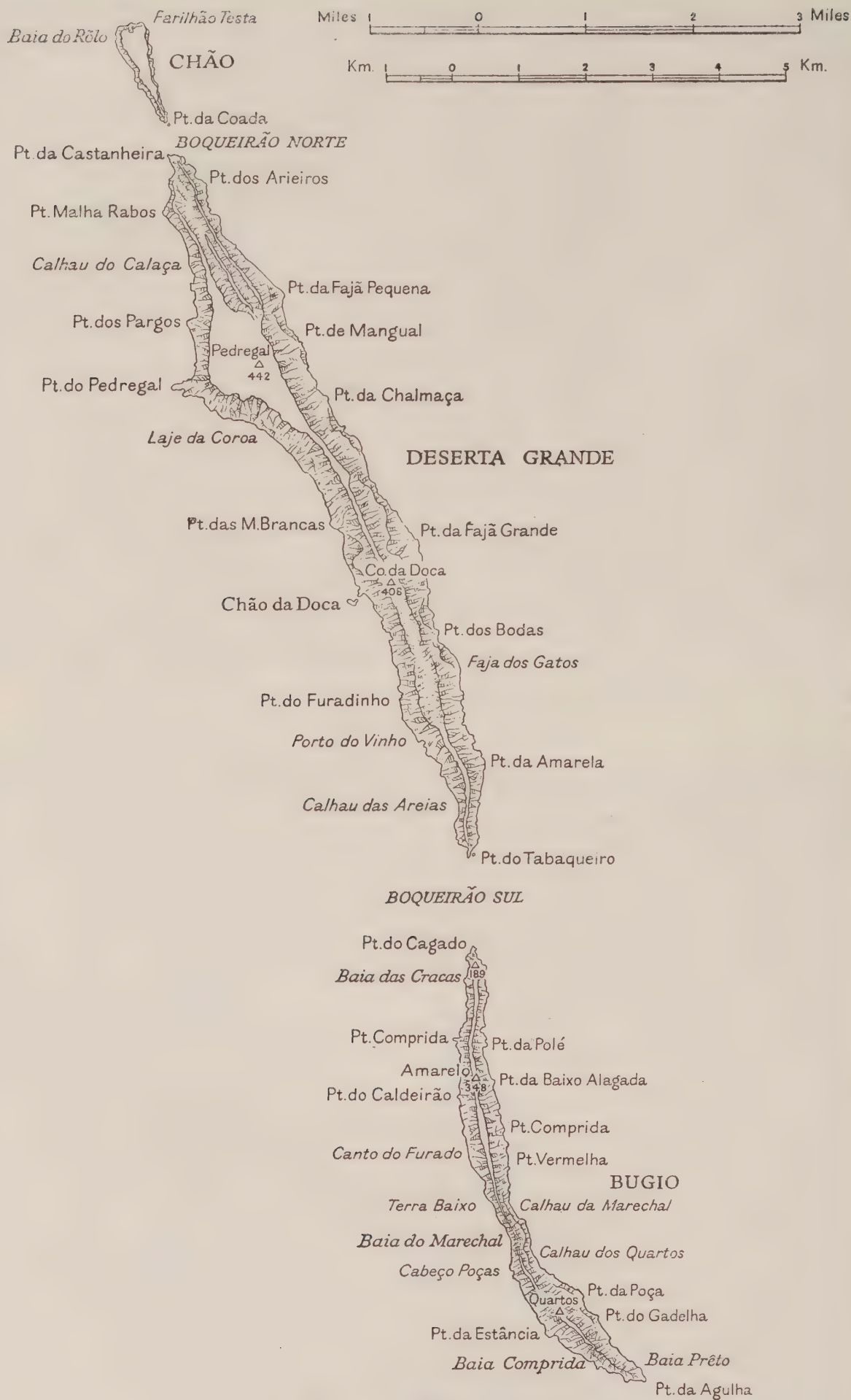


FIG. 41. *The Desertas*

now uninhabited, and although colonization has been attempted in past centuries, lack of fresh water has always made permanent settlement difficult. In 1590 wheat and rye are said to have been sown on the islands, which were then inhabited by eight men and a factor. In the middle of Deserta Grande are the remains of several threshing



FIG. 42. *The Desertas from the north-west*

floors, cattle pens, cottages, and a chapel. A road once extended from the landing-place on Deserta Grande to the southern end of the island.

At the present the islands are given over to sea-birds, wild goats, and rabbits. They are visited by sportsmen for shooting wild goats, said to be descended from domestic goats placed on the island in the fifteenth century, and by fishermen, who come to catch seals that frequent the caves on the north coast of Deserta Grande. Shearwaters are numerous, and several thousands of these birds are caught annually for their flesh, oil, and feathers. Orchilla was formerly gathered for the manufacture of purple dye, but does not now pay for the gathering.

THE SELVAGENS

THE Selvagens,¹ sometimes known as the Salvage islands, lie between Madeira and the Canaries, 135 miles south of Bugio. These small islands belong politically to Portugal, although they are nearer to the Canaries than to Madeira (Fig. 1). They are composed of two distinct groups of islands and rocks separated by a channel $8\frac{1}{2}$ miles



FIG. 43. *Selvagem Grande*
Relief shown by form lines. Heights in metres

wide. The northern group consists of Selvagem Grande and two off-lying rocks known as the Palheiros. The southern group is made up of two islands named Selvagem Pequena and Ilhéu de Fora, sometimes called Great Piton and Little Piton respectively, together with several rocky islets and reefs.

Selvagem Grande (Fig. 43) is about 3 miles in circumference and has several small islets and rocks scattered around it. It is a plateau

¹ 'Selvagem' takes the plural form of 'Selvagens' in Portuguese. The word literally means 'savage', but the islands are often called 'Salvage' islands in English books and maps.

surrounded by cliffs which rise precipitously for 200 or more feet from the sea, except on the south coast, where, although higher, they have a more gradual slope (Photo. 90). The plateau rises to two peaks, namely Burt peak (Pico de Atalaia), 515 feet in height on the west, and Pico dos Tornozellos, 459 feet, on the eastern side of the island. A good landing can be effected at the head of the Enseada das Cagarras on the south coast, and landing is also possible on the east (Photos. 91 and 92).



FIG. 44. *Selvagem Pequena and Ilhéu de Fora*

Selvagem Pequena (Fig. 44) lies $8\frac{1}{2}$ miles to the south-west of Selvagem Grande. It has a low rocky coast and is, for the most part, sandy and undulating with an average height of between 35 and 45 feet. At the northern end of the island is Pico de Veado (158 ft.). Ilhéu de Fora (Fig. 44) is about a mile to the west of Selvagem Pequena and has a sandy surface and an average height of between 25 and 35 feet. In the north-west there is a rocky summit of 56 feet. Landing is not easy on either of the islands. A chain of rocks, reefs, and shoals extends for 2 miles north of Ilhéu de Fora and terminates in the reef known as Baixa de Leste.

Both groups are uninhabited and are very bare of vegetation. In the summer months landings are made on Selvagem Grande to kill and cure shearwaters, which are sold in Madeira as a delicacy for good prices. The phosphates of the island are also exploited, the diggings being in the centre of the island. Near by there is a concrete tank which collects the rain of the winter months for use as drinking-water during the summer. The two smaller islands are sometimes visited by fishermen from the Canaries. The pirate Captain Kidd (1645-1701) is supposed to have buried treasure on Selvagem Grande, and expeditions were sent out in 1830 and again in 1890 in vain attempts to find it.

CHAPTER XII

THE AZORES

THE Azores, sometimes called the Western Islands, are situated towards the middle of the north Atlantic. Their total area is about 888 square miles, and they have more than a quarter of a



FIG. 45. *The Azores*

million inhabitants. The area and population of each of the nine islands are given in the following table.

<i>Island</i>	<i>Area in square miles</i>	<i>Population in 1930</i>
S. Maria . . .	37	7,055
S. Miguel . . .	288	127,162
Terceira . . .	153	48,380
Graciosa . . .	23	8,350
S. Jorge . . .	92	13,772
Pico . . .	167	20,112
Fayal (Faial) . . .	65	21,432
Flores . . .	55	6,999
Corvo . . .	7	673

The islands lie along a line which runs roughly from south-west to north-east and are arranged in three groups (Fig. 45). Two stretches

of sea, of about 100 and 125 miles respectively, divide the three groups from one another, and the distance between the two farthest points of the two most widely separated islands is nearly 400 miles.

The eastern group consists of the small island of S. Maria, the first to be occupied by the Portuguese, and S. Miguel, the largest and most thickly populated of the Azores. S. Miguel is almost exactly the same size as Madeira, but it has about half the latter's population. Ponta Delgada (18,000), the chief town in the Azores, is on the south coast of S. Miguel and has a good harbour.

The central group includes Terceira, the 'Third' of the Azores to be discovered by the Portuguese, Graciosa, S. Jorge, Pico, and Fayal, which are strung out along a distance of about 100 miles. The port of Angra do Heroismo (12,000) is on the south coast of Terceira, the island which comes second to S. Miguel in number of population. The port of Horta (7,600), with a good natural harbour, lies on the south-east coast of Fayal and is one of the world's chief cable stations.

The western group is made up of the small and thinly-peopled islands of Flores and Corvo.

During the latter part of the nineteenth century the population of the Azores fluctuated with no marked tendency towards increase or decrease. The total population of the archipelago, according to recent censuses, is given in the following table.

<i>Date</i>				<i>Population</i>
1881	.	.	.	269,401
1890	.	.	.	255,534
1900	.	.	.	255,892
1910	.	.	.	243,378
1920	.	.	.	232,012
1930	.	.	.	253,935
1940	.	.	.	286,969

Decreases in population were due more to emigration than to any other cause. The considerable increase of population since 1920 has been a result of the restrictions which have prevented emigration to the United States.

S. MARIA

S. MARIA, the easternmost of the Azores, is about 10 miles long by 5 miles wide and has an area of about 37 square miles (Fig. 46). It is the most southerly island of the archipelago, and claims to have a drier climate and to be healthier than any other island of the group. In 1580 Christopher Saxton used the longitude of S. Maria as his prime



FIG. 46. S. Maria

Streams are not marked on this map

meridian on a general map of England and Wales, Greenwich being shown as $23^{\circ} 32'$ E., while the true difference between the island and Greenwich is just over 25° .

The original settlers of the island came from Estremadura and Algarve, two southern provinces of Portugal. The pronunciation of Portuguese by the islanders differs considerably from that of the inhabitants of the other islands.

In February 1493 Christopher Columbus, on his return voyage from America in the *Niña*, anchored off the north coast of S. Maria

near Ponta dos Frades. Some members of the crew landed to visit the small church of Anjos, where they gave thanks for safe delivery from a great storm which had nearly overwhelmed their caravel off the Azores. The first news of the discovery of the Indies was therefore given to the inhabitants of S. Maria.

PHYSICAL GEOGRAPHY

Relief

This island lacks the volcanic features such as the cones and crater-lakes which are so characteristic of the other islands of the Azores; it is partly composed of limestones and clays of Miocene age and is geologically the oldest land-mass of the archipelago. There are numerous caverns in the limestone. The island was elevated in later geological time, but no volcanic activity or serious seismic disturbance has been recorded during historic time.

The island can be divided into two distinct physical regions. The western third is a plateau about 2 or 3 miles in width, about 300 feet above sea-level, and falls gradually westward to the sea, although the valleys which notch the western edge are quite deep. This abrasion platform has been raised above the sea for a relatively short period of time (Photo. 94).

The larger eastern part of S. Maria is quite different in character, being chiefly composed of a range of hills which rises abruptly in the south-east and extends in a general north-westerly direction across the island. The hills have an average height of between 1,200 and 1,400 feet, but the double-peaked mountain of Pico Alto (1,936 ft.), in the centre of the island, is its highest point. The whole of the eastern side of S. Maria is dissected by streams, the valleys of which become more steep-sided and deeper near the sea.

Water-supply and Vegetation

There is said to be an abundance of fresh water for domestic use in the island. On the north and east sides and near the south-east angle are copious springs of excellent water. In the limestone areas water is not so plentiful, and occasional droughts cause temporary shortages of water. In the summer of 1876 all the crops were lost owing to drought. The inhabitants were reduced to great straits and there was much emigration to Brazil. Like all the islands in the Azores, S. Maria was densely wooded when first discovered. At the present time, except in the valleys, there are few trees. In the centre of the island



93. *The Bay of S. Lourenço, S. Maria*



94. *Coastal platform near Vila do Porto, S. Maria*

the valleys are tree-clad, trees being limited to candleberry myrtle (*Myrica Faya*), louro (*Laurus indica*), and pau branco (*Picconia excelsa*). In the ravines there is good covering of smaller shrubs and plants and New Zealand flax grows wild.

Coasts

The island of Santa Maria is difficult of access, its coasts being steeply cliffed and guarded by several dangerous reefs. The main anchorage is in the south-west at Vila do Porto bay, where a rocky but sheltered position is available.

The western coast of the island from Ponta de Malmerendo to Ponta do Cabrestante ($4\frac{1}{2}$ miles long) is formed by a continuous line of cliffs, about 100 feet high, the seaward edge of the low plateau. The steep-sided islet of Vila lies off the south-western headland.

The north-western shore is also low, but east of Ponta dos Frades the cliffs rise abruptly. There are several bays in which landing is possible but not easy. The country behind the coast rises to 1,578 feet within 1 mile in the central area, but elsewhere the slopes are less abrupt. There are no good roads leading to the bays on this coast.

Cliffs continue along the east coast and rise almost sheer from the sea to 700 feet. S. Lourenço bay opens out in the north between the headlands of S. Lourenço and Papagayo, with a small island off shore. Landing is possible in a sandy cove at the northern end; the shores of the bay are lined by a number of cottages and a road which continues overland to Vila do Porto (Photo. 93). South of S. Lourenço bay the coast trends to the south-east, and is steeply cliffed, with a number of bays. A road leads to the hamlet of Maia.

The southern coast is cliffed in the east, but opens out to the large bay of Prainha. To the west, Marvão and Malmerendo points enclose the bay of Vila do Porto, which is rock-fringed along the eastern shore, but provides a comparatively safe anchorage. The small town of Vila do Porto straggles down to the head of the bay. Such roads as the island possesses branch out from this town to the north and east coasts.

HUMAN GEOGRAPHY

Distribution of Population

In 1930, S. Maria had a population of 7,055. The most important place is the port of Vila do Porto (1,622 inhabitants), situated on rising ground overlooking a small bay (Fig. 46). The place was once

defended by forts, now dilapidated. Some of the churches date from the sixteenth century; one has a fine tower. The port is an open roadstead, boats landing at a small mole. In the south-east of the island is the village of S. Espírito, which, with its district, has a population of 2,315. S. Lourenço is a small settlement about half a mile west from S. Lourenço bay on the east of the island. This bay is sometimes used for landing when surf conditions are bad at Vila do Porto.

The only other places of any size in S. Maria are S. Pedro and S. Barbara, which are inland villages lying to the west and east of Pico Alto respectively. On the western plateau there are few houses, but in the rest of the island, apart from the main hill ridge, buildings are evenly scattered over the countryside.

Industries

S. Maria is fertile and once produced the richest cereal crops of the whole archipelago. Millet is especially grown, but wheat, maize, potatoes, and a small quantity of vines are also cultivated. There is some cattle-breeding, the western plateau being suited to this industry; about 200 cattle are exported annually. The cattle were originally imported from the south of Portugal and are remarkable for the great length of their horns. Some of the best horses in the Azores are bred in S. Maria.

A red volcanic clay known as *pozzolana* is used for making a hydraulic cement. A small industry is carried on in pottery and in the export of potter's clay. The chief merit of this pottery consists of the graceful amphora shapes of many of the vessels made. They are coated with red ochre and have a bright colour and lustre. These vessels are exported to the other islands of the group.

There is some fishing and sealing from S. Maria. There is a whale-oil rendering plant and a fish cannery on the island.

Communications

The main centre of communications is Vila do Porto. One road leading from this port to S. Lourenço ($7\frac{1}{2}$ miles) passes below the southern side of Pico Alto. About 1 mile south of this mountain a branch road leaves the S. Lourenço road for S. Espírito and Maia on the coast.

Another road which leaves Vila do Porto in a northerly direction branches about $2\frac{1}{2}$ miles from the port. One branch proceeds to the sea at Anjos near the north coast. The other passes S. Pedro and pursues a north-easterly direction towards another part of the north coast.



FIG. 47. S. Miguel

It is worth noticing that there are no coastal routes round the island, and also that the western plateau has very few roads or tracks of any kind.

THE FORMIGAS ROCKS

The Formigas rocks, or 'the ants', are a group of black rocks about 20 miles north-east of S. Maria and 23 miles south-south-east of S. Miguel (Fig. 5). Being the extreme eastern point of the archipelago ($24^{\circ} 41' W.$), they were the first part of the Azores to be discovered by Cabral in 1431. Their greatest length is about 800 yards and greatest width about 150 yards. The southern half of the group rises to 27 feet and forms a cluster of closely connected rocks with a bay on the west side; the northern part consists of a number of somewhat more scattered rocks of which Hormigon (Formigão), the highest (35 ft.), stands slightly apart from the others. In outline the group appears like a few black hummocks or crawling ants. The rocks and the bank from which they rise are composed chiefly of volcanic material, with patches of fine white sand, broken shells, and fragments of branch coral, the calcareous deposits being similar to those in S. Maria. Landing can be made in smooth water, particularly on the southern rocks, but during rough weather waves break over the whole group.

The Formigas rocks form the northern summit of a submarine ridge, the summits of which approach the surface at several other places. The southern extremity of this ridge forms a rocky shoal, known as the Dollabarets. It was named after Captain P. Dollabarets, who first called attention to it in 1788. This shoal lies about $3\frac{1}{4}$ miles to the south-east of the Formigas rocks and has a least depth of $10\frac{1}{2}$ feet. In times of smooth water it is dangerous to shipping since its position is not then indicated by breakers.

S. MIGUEL

PHYSICAL GEOGRAPHY

S. MIGUEL (São Miguel), or St. Michael's as it is often called by the British, is about 40 miles long and from 5 to 10 miles broad. With an area of 288 square miles, it is by far the largest, and the richest, of all the islands of the Azores.

Relief

Physically, the eastern extremity of S. Miguel (east of a line from Achada to Ribeira Quente) is the oldest and most dissected part of the island (Fig. 47). It consists of a central ridge that drops steeply on all sides to the coast, the mountain sides being incised by many swift streams which flow in narrow, steep-sided valleys. The mountains are highest and narrowest at Pico da Vara (3,626 ft.), which rises abruptly about 600 feet at the eastern end of the wind-swept ridge. The flat top of the ridge stretches for 3 miles to the west of Pico da Vara, scarcely varying 300 feet in height throughout its length; its surface is covered with a loose, sodden, pumice gravel derived from partly disintegrated tuffs. Towards the west the crest broadens out slightly and is known as the Planalto dos Graminhaes, a tableland nearly 3,000 feet high and so often covered with cloud that in places it is boggy. West of this upland the summit of the central ridge becomes more irregular and declines to about 2,000 feet.

The southern slopes of the main ridge near Furnas have been broken by intense volcanic activity into a large crater-like depression, about 4 miles long by 2 miles wide. The southern part of this irregular hollow is occupied by Lake Furnas, which lies at 865 feet above sea-level; the lake has no outlet, being encircled by steep, high walls on all sides except the north-east, where a gap leads to the town of Furnas. The floor of the northern part of the hollow forms the plain around Furnas and stands at about 700 feet above the sea, to which it drains by means of a deep valley cut through the crater-rim.

Immediately west of Furnas the medial ridge of S. Miguel expands into a broad, flat platform, with a general level of 1,700 feet, but with several steep conical peaks rising to over 2,000 feet, the most prominent being Pico d'El Roi (2,211 ft.). This upland rises on its western side to a broad mountain mass that has no sooner assumed a medial arrangement at Monte Escuro (2,920 ft.) than its east-to-west aline-

ment is broken by the crater at Lake Fogo. This irregular-shaped basin is entirely enclosed by steep walls that culminate in Barrosa (3,114 ft.). West of Barrosa and the Serra de Agua de Pau the high-land ridge peters out and descends through a number of secondary peaks to low, hilly country.

The 'waist' of S. Miguel, between Lagoa and Relva on the south and Ribeira Grande and Capellas on the north, is hilly but not mountainous and has no central ridge. Inland from Lagoa the country rises gradually to a tableland that is dotted with scattered volcanic cones, none of which rises much above 1,000 feet. The relief north of Ponta Delgada is more rugged, as the plateau, although still about 600 feet in altitude, is dominated by two lines of hills, the northern of which rises to 1,270 feet and the southern to 1,526 feet (Serra Gorda). This section contains the main cultivated areas of S. Miguel; nowhere else in the island are communications between the northern and the southern coastal towns so easy, yet, in spite of the lowness of the relief, the coasts consist of almost unbroken cliffs.

The western part of S. Miguel is entirely occupied by a gigantic crater, the Caldeira das Sete Cidades, which has the shape of a vast cone truncated irregularly at about 2,000 feet. The rim of the crater has an average elevation of about 1,900 feet and a maximum elevation of 2,808 feet. It is quite intact and drops on all sides except the east to cliffs 300 and 800 feet high. The seaward slopes are fairly regular, although a few secondary cones and craters occur; the eastern rim is prolonged south-eastwards in a complicated ridge, the surface of which (over 2,500 ft.) is broken by numerous minor crater-hollows.

The main crater, the Caldeira das Sete Cidades, is a composite basin nearly 3 miles in diameter, with precipitous sides in places 1,500 feet high but with a remarkably uniform declivity. The floor of the basin has a complicated topography; the western side consists of secondary cones and craters; the central area is occupied by the two large lakes, Grande and Azul, at 866 feet above sea-level; the eastern part contains two minor craters, very perfect in form and each partly filled with a small lake lying at several hundred feet above Lake Azul (Photo. 95).

S. Miguel has been the scene of several great eruptions within the last five hundred years, some of which have greatly changed its topography. Details of these eruptions are given in Appendix A; evidence of continued vulcanism in the form of hot springs and fumaroles is given in the following pages.

Drainage and Water-supply

All the highland slopes of S. Miguel are furrowed by the narrow valleys of fast streams, which in the east drain from the central watershed and in the west from the upper flanks of the outer rim of the great caldeira. The lower 'waist' of the island has practically no watercourses but derives an ample water-supply from rains, from underground sources, and from the adjacent mountain areas.

Owing to the copious rainfall in most months of the year, the streams and springs of the island are perennial and in the winter and spring the former may become greatly swollen. Consequently, the water-supply is ample all the year. Ponta Delgada, the only large town of S. Miguel, obtains an unlimited quantity of good drinking-water from the south-eastern flanks of the Caldeira das Sete Cidades, the supply being carried, mostly underground, for 9 miles in pipes.

The island has three large basins of interior drainage: the Lagoa das Furnas, which covers about 3 square miles and has a maximum depth of over 50 feet; the Lagoa do Fogo, which is 1 mile long by half a mile wide; and the two larger lakes of the floor of the Caldeira das Sete Cidades. The latter, although separated only by a narrow neck of land through which there is an opening, are of very different shades of colour, the larger (Lagoa Grande) being bright emerald and the smaller (Lagoa Azul) deep blue (Photo. 95). Their depth generally varies from 6 to 80 feet, but on the north side of Lagoa Grande there is a hole nearly 350 feet deep which is probably one of the former vents of the volcano. The lakes abound in carp, trout, and char.

In addition, there are in S. Miguel numerous smaller crater-lakes, some of which, as for example Lagoa Congro, are solitary mountain tarns while others, such as the group near Lagoa Carvao, are clustered together and may actually overflow into one another after heavy rains.

The island is rich in mineral springs, hot and cold, and in fumaroles or issues of vapour from crevices. Notable among the springs are the two copious upwellings of aerated hot water containing iron and sulphuretted hydrogen, $1\frac{1}{4}$ miles east of Caldeiras da Ribeira Grande, and that at Lombadas, 3 miles to the south, which yields an aerated mineral water much liked in Portugal. Other springs and geysers are found near Furnas ('furnaces'). These issue in different parts of the valley at various temperatures, cold and boiling water being ejected in close proximity, sometimes gently and sometimes violently. The most active include the Caldeira de Pedro Botelho, which ejects turbid water to a height of several feet, and the Caldeira Grande, a boiling well that is protected by a circular wall 6 feet high. The waters of the

various springs and geysers contain sulphur, iron, and other minerals, their mineral content, and hence their curative properties, differing greatly. They may be used beneficially in cases of rheumatism, skin diseases, and certain throat and chest affections, but some of them are very powerful and should not be taken without medical advice. There is a large government bathing establishment at Furnas, fed by the sulphur-laden waters of the Caldeira Grande and the iron-bearing springs of Quenturas. The ground in the vicinity of some of the geysers and hot springs is encrusted with crystals of sulphur, alum, and soda.

Vegetation

On its discovery S. Miguel had considerable areas of lofty woods of juniper (*cedro*), faya, and laurel. The boles of large trees still occasionally unearthed from volcanic tuffs near Sete Cidades and Furnas indicate that this forest growth occupied a belt of country extending from east to west along the middle and higher flanks of the mountains. Subsequently, great volcanic eruptions and the activities of man and animals destroyed most of the original forests. Where the indigenous flora has survived there occur the tree-heath, canary laurel, faya, myrsine, and Viburnum, the last named being more generally distributed over this island than it is on Pico. During the last century an extensive reafforestation has taken place near some of the larger towns, and this, combined with the natural growth of shrubs and an abundance of ferns and mosses, has given the mountains a wooded appearance.

To-day the cover of vegetation up to 2,000 feet consists mainly of cultivated plants and an intermingling of indigenous and of foreign trees and shrubs. The tree zone actually extends up to about 3,000 feet and usually carries an undergrowth of shrubs and ferns. Beyond the limits of tree-growth this undergrowth forms the predominant vegetation.

The larger forests of S. Miguel are composed mostly of poplars, eucalyptus, pine, araucaria, elm, oak, acacia, chestnut, and a few other introduced trees. There are three chief forested areas: two are on the hill-slopes at about 1,000 to 2,000 feet, the one stretching between the lake of Furnas and Povoação on the south of the island and the other between S. Braz and Grammas on the north side; the third area is on the lower central section of the island inland from Rabo de Peixe and stretching thence over the plateau to the scrub-clad slopes near Lagoa (Fig. 47). The latter forest consists largely of plantations of pine

(*P. maritimus*), poplar, acacia, eucalyptus, and other trees which provide timber for the making of fruit-crates. In addition to these forests there are many patches of woodland scattered around the mountain slopes in the eastern half of S. Miguel.

There is also, apart from the tall tree-growth, a considerable acreage of scrub, composed chiefly of heath, juniper (*cedro*), laurel, and *Viburnum*. The largest areas occur between Capellas and Pica da Pedra on the north side of the island and between Fajã da Cima and Lagoa on the south. The western part of S. Miguel, which is lacking in true forests, has patches of scrub on the floor of the Caldeira das Sete Cidades and on its flanks, more particularly near Candelaria and Feteiras.

The scattered nature of the woodland and scrub, as shown on Fig. 47, conveys an inadequate idea of the luxuriant plant-cover of much of S. Miguel. Below 3,000 feet the vegetation is often profuse and exuberant. The basin of the Caldeira das Sete Cidades is rich in large ferns and the paths are well shaded by *araucaria* and other trees. The road from S. Braz to Furnas runs between magnificent hedges of *hydrangea*, while the tree-heath, often 12 to 14 feet high, *faya*, and juniper are plentiful even at higher levels, and the beds of the torrents are shaded by fern fronds (*Woodwardia radicans*) up to 8 feet long. The floor of the Furnas valley is under crops and pasture, while the adjacent precipices bear a great wealth of plant-life, the pine-groves of the southern slopes being especially fine. Even the lower land of the 'waist' of S. Miguel has a well-wooded aspect since trees, including *faya*, laurel, *vinatico*, and cypress, are planted in a regular, wall-like manner and trained in rows around orchards to protect them from the wind. Often a hedge of the common reed (*Arundo donax*), which grows to a height of 12 to 15 feet, serves the same purpose.

The vegetation of the high plateaux and of the summits of the central ridge above 3,000 feet in eastern S. Miguel is much more scanty. The plateau near Furnas, called the Achadas das Furnas, is covered with low patches of tree-heath, ling, broom, and wortleberry, the fruits of the last-named scrub being gathered for eating. The thin plant-cover on the mountain backbone east of Furnas is monopolized by stunted laurels and junipers, seldom more than 3 feet high and in windy places growing semi-prostrate on the ground. Dwarf growths of wortleberry and *myrsine*¹ as well as the *Culcita* fern and a tussocky moss (*Polytrichum*) also reach to the summit. The wetter parts of the

¹ *Myrsine Africana* L., the *tamucho* of the Azoreans, is a shrub similar to box, which flowers in spring and bears its slowly ripening fruit all through the winter.



95. *Caldeira das Sete Cidades, S. Miguel*



96. *Terraced cliffs, south-eastern S. Miguel*



97. *Coast of Vila Franca island*



98. *Lagoa from the east*

Planalto dos Graminhaes support a bog vegetation which in places includes *Juncus* and peat moss (*Sphagnum*).

The timber of the forests and woodlands of S. Miguel is used mainly for construction, firewood, and packing materials. The stems of the tree-heath form a favourite firewood. Among the unusual features are the utilization of tree-boles unearthed from volcanic tuffs for construction purposes and the gathering of the silky down of the *Culcita* fern for use in the filling of mattresses.

Coasts

The coasts of S. Miguel are precipitous in the east, south, and west and slope more gently in the north. There is little or no coastal plain, and communication overland is made difficult by the height of the interior, only the central section having many roads inland from the road which encircles the coast. The south coast is more easily accessible than the north, and besides Ponta Delgada there are small harbours at Vila Franca, Lagoa, and Povoação. On the north coast, Rabo de Peixe, Porto Formoso, and Porto Capellas are the only ports of any significance.

The short eastern coast, about $8\frac{1}{2}$ miles long between Ponta da Ribeira and Ponta Retorta, has steep cliffs, with several outstanding promontories falling sheer to the sea. Deeply incised valleys are cut into the slopes of the mountains, which rise in the south-east to 2,900 feet about $1\frac{1}{2}$ miles inland. There is a stony beach round Ponta do Arnel, with a small jetty, which is difficult of access.

The southern coast to Ponta da Galera has a fairly regular outline, with alternating cliffs and coves, fronted by a narrow fringe of rocks and reefs. There is very little coastal plain, and the hills rise fairly steeply inland, particularly towards the east, with fields extending almost to their summits (Photo. 96). Four landing-places are available here. The most easterly is Povoação, which faces a shingle beach formed at the mouth of several torrents. It is used only by small boats, there being no jetty or wharf. Most of the town lies inland, the houses being alined along the streams; the main road from Furnas to the north-east passes through it. Ribeira Quente occupies a small bight 3 miles west of Povoação, and like it is a typical fishing-village, with no landing facilities; a steep newly constructed road leads inland in 3 miles to Furnas, passing through several tunnels. Vila Franca bay is the best anchorage on this stretch of coast. The island of Vila Franca, an extinct volcano, the crater of which is occupied by the sea, lies half a mile to the south (Photo. 97). A small basin for fishing-

craft has been constructed from the mainland and can accommodate vessels of not more than 80 tons. A sea-wall has been built along the beach: the town stands on the cliffs overlooking the bay at the foot of steeply rising hills, and is traversed by the coast road from Ponta Delgada to Furnas. It is also possible for small vessels to use a narrow entrance into the crater-lake on Vila Franca Island. Landing is also possible west of Ponta da Pyramida, where a sandy beach, at the foot of cliffs, is connected at its head with the coastal road.

A large bight roughly $11\frac{1}{2}$ miles long extends to the west of Ponta da Galera, bordered by low lava cliffs, with several coves and beaches. There is a fertile plain inland, with a few scattered wooded hills which form a low divide between the south and north coast; therefore the coastal route has many ramifications, and there are several cross-country connexions with the north coast towns, such as Ribeira Grande and Rabo de Peixe. Ponta Delgada on the west side of the bight has by far the most important harbour in the island, and is the largest town in the Azores. An open roadstead, it is sheltered by a long breakwater built from the western end of the town. The built-up area lies along the shore, and from it roads radiate to all the chief villages of the island. A second smaller harbour is at Lagoa, on the eastern side of the bight, where a small basin with a rocky entrance is used by local fishing-craft (Photo. 98). Landing is also possible at Caloura, a cove on the western side of Ponta da Galera, and on the beaches below S. Roque.

A succession of cliffs extends north-west of Ponta Delgada to Ponta da Ferraria, behind which the land gradually increases in height to the Caldeira das Sete Cidades. A road runs along the top of the cliffs and most of the houses are concentrated in four small villages along it. The north-western coast is also steeply cliffed, and off-lying reefs and rocks make it difficult of approach. The village of Mosteiros, which has grown up on a tongue of land below the slopes of the Caldeira, is visited by small local boats.

The 20 miles of coast from Bretanha to Ribeirinha points is first composed of the convex shore of the Caldeira das Sete Cidades, which gives place eastwards to a wide bight, with rocky coves and discontinuous cliffs. The western part is a cliffed coastline with dangerous reefs and no ports. In contrast there are several small harbours along the shores of the bight. The most westerly is Porto Capellas, where a small basin, with good depth of water, is used by local fishing- and whaling-boats. Cliffs 300 feet high surround the basin, and a rough cart-track leads up their face to the houses of the village and the Ponta

Delgada road. This is probably the best landing-place on the north coast. About 7 miles to the east there is a small cove with a slipway facing the village of Rabo de Peixe. The houses of the village are built along the edge of the cove, and fields cover the low gently sloping plain which extends behind it. Landing is also occasionally possible on the long sandy beach in the shelter of Forte point; behind a narrow belt of dunes lies the town of Ribeira Grande, with good communications inland to Ponta Delgada and along the north coast.

The eastern part of the north coast is not easily accessible, having sheer cliffs and rock-strewn beaches. There are several prominent headlands, such as Morro Grande, Formoso, Maia, and Ajuda, which break the fairly regular outline of the shore. The fishing refuges are at Ponta da Pontinha, south-east of Morro Grande, at Porto Formoso a cove with a small slipway, $3\frac{1}{2}$ miles to the east, and at Maia, a bight with a large boulder beach. There are no beaches in normal use east of Ponta da Ajuda. A main road follows a winding course parallel to the coast crossing the many ravines which dissect the hill-sides, but the only connexion across this part of the island is the road from Maia to Furnas.

HUMAN GEOGRAPHY

Distribution of Population

In 1930 there were 127,162 people living on S. Miguel, or about half the total population of the entire archipelago. At this time the density of population was 441 persons to the square mile, which exceeded that of any other island of the Azores. The number of foreigners was less than 700, the majority of whom were from the United States of America and Brazil. Emigrants returning from these two countries have provided a marked stimulus to the progress of the island. The typical Azorean peasant who has never left the island is illiterate, superstitious, and, although hard-working, seldom free from want. The only large town is Ponta Delgada (18,022 inhabitants in 1930), the other settlements with over 5,000 people being Ribeira Grande, Vila Franca do Campo, and Lagoa. The distribution of population is markedly peripheral; apart from the town of Furnas and the village of Sete Cidades, there are few habitations more than 2 miles from the sea (Fig. 47).

Most of the houses in the towns are solidly built of basalt, with sash windows and red-tiled roofs. The best domestic architecture is to be seen in the manorial houses of the large landholders, and the worst in

rural areas, where many of the dwellings consist of a single room, often with earthen floors and no heating except that given by cooking-ovens. Even humble homes usually have a huge chimney that rises above a large stone oven, occasionally 8 feet wide, in which the cooking is done. In some of the most backward villages the houses face away from the roads and are entered through a yard in which pigs and poultry are kept. Ponta Delgada, Lagoa, Agua de Pau, Vila Franca do Campo, Povoação, Ribeira Grande, Rabo de Peixe, and Furnas are lighted by electricity.

Eastern S. Miguel. The high mountain backbone of eastern S. Miguel forces most of the habitations to within a comparatively short distance of the coast. Except in the south-east and on the cliffs south of Furnas, a thin but fairly persistent strip of houses and villages stretches along the coast. The population is densest on the coastlands between Agua de Pau and Vila Franca do Campo, on the floor of the Furnas valley, and in the valleys converging on Povoação.

The town of Agua de Pau (3,628 people in 1930), which lies on the lower hill-slopes at about three-quarters of a mile from the sea, has several imposing-looking churches. The country east of it is hilly and there are few hamlets until Vila Franca do Campo is reached. This town, with 6,373 inhabitants in 1930, is the administrative centre of a *concelho* of over 11,000 people. Vila Franca do Campo was the capital of S. Miguel until 1522, when it was overwhelmed by a great landslip caused by earthquakes; a sea wave completed the destruction, and only 70 of its 5,000 inhabitants are said to have escaped. A new town was built just west of the ruins of the old, but it too was almost destroyed by earthquake in 1591 and was much damaged in 1630. The present town is built mainly on the brow of the cliffs facing a small harbour that is partly protected by a volcanic islet. The built-up area includes a square in front of the church (a large building much damaged by the earthquake of 1630), a public hospital, and municipal offices.

The town supplies provisions to ships and in most years has a small export of pine-apples and oranges. The main coastal road east of Vila Franca is bordered for most of its course with detached dwellings, since the villages, such as Ponta da Garca (2,900 people in parish), consist largely of one street which to more than one visitor has seemed 'of interminable length and crowded with urchins and sucking pigs'.

Between Ponta da Garca and Povoação there are very few houses on the steep cliffs of the coast, but midway a slight recession of the cliffs has allowed the formation of a beach which forms the site of

Ribeira Quente. This small village is threatened with encroachment by the sea, which in 1880 carried away a number of cottages. Although merely a fishing-hamlet, it has a main road to Furnas. The town of Furnas (2,443 people) lies at about 700 feet at nearly 3 miles from the sea. Advantageously situated on the floor of a vast crater in an area with numerous mineral springs, it has become a favourite spa and summer resort, with bathing establishments, hotels, a restaurant, and large gardens and parks. Most of the dwellings are whitewashed, stone structures of one story, with red-tiled roofs and set close on the street. During the great eruption of 1630 many houses were buried under heavy falls of ashes.

The steep mountain ridges east of the Furnas valley are mainly forested and are practically uninhabited. However, near Povoação a number of swift mountain streams have cut deep valleys in the mountain slope and have formed a small lowland at their mouths. This patch of coastal plain is the site of Povoação, a town (including Ribeira Quente) of 7,253 inhabitants and the main centre of a *concelho* of 12,384 people (Photo. 103). Cabral landed at this spot on his discovery of the island in 1444 and founded a small settlement. In 1591 a great part of the village was washed away by a sea wave during an earthquake. Another disaster occurred in 1744, when heavy rains on the mountains caused a great flood at Povoação that destroyed many of the houses. To-day the nucleus of the town occupies the level ground at the convergence of five or six streams, while six long lines of white-washed, red-tiled cottages radiate up the mountain spurs between the fertile valleys.

The south-eastern corner of S. Miguel is high, rugged, and wind-swept, nor is there any coastal road. The steep slopes and coastal precipices almost preclude settlement, the only villages being Fayal da Terra, a village of 1,000 people on a small riverine plain, and Agua Retorta, an upland hamlet with about 1,000 people in its vicinity. In 1744, and occasionally since, Fayal da Terra suffered from severe floods.

The distribution of population on the north-east and north coasts of S. Miguel from Rebentão to Porto Formoso follows a uniform pattern, the houses and hamlets keeping to the lower hill-slopes at a few hundred yards from the sea. In very few places are the dwellings placed near the shore; in equally few are they more than a mile from it. The whole of the north-eastern area forms the *concelho* of Nordeste, which contains about 10,000 persons. The chief villages are Nordeste (2,220 people in parish) and Nordestinho. This region was

formerly a rich wheat-producing area, and Nordeste was officially created a 'town' as early as 1514. Half a century later the fertile soils were buried under thick layers of pumice and the agriculture has never recovered its former prosperity. Farther to the west the villages include Maia, a small fishing settlement and the centre of a parish of 2,481 inhabitants, and Porto Formoso (1,800), which lies partly at the head of a small bay and partly across the neck of a flat-topped promontory (Photo. 104). Both of these parishes come under the administration of Ribeira Grande.

Central S. Miguel. The hilly 'waist' of S. Miguel contains nearly two-thirds of the total population of the island, but even here, although the relief is lower, most of the people live near the coast. On the south the main settlements are Ponta Delgada (18,022 people) and Lagoa (7,275 inhabitants). The former is the capital of the island and the commercial centre of the whole archipelago (p. 290). Lagoa is situated in one of the most fertile parts of S. Miguel (Photo. 98). Its parish (11,000 inhabitants) produces pine-apples, sweet potatoes (hence the local alcohol plant), and a variety of other crops. The town also has a small manufacture of pottery.

On the north coast the main settlements are Ribeira Grande (8,060) and Rabo de Peixe (4,000). The former is a large, well-built town standing on rising ground on both banks of a swift stream which provides power for a few corn-mills. Ribeira Grande has long been a centre of local manufactures, including small agricultural implements and coarse linens. It is well paved and has a public hospital, several large churches, and many shops. Rabo de Peixe owes its importance mainly to its position at the head of a small bay that affords good shelter for fishing-vessels. The population of the parishes of the other larger settlements of the north coast are Ribeira Secca, 4,000; Fenaes da Luz, 1,500; Capellas, 3,268. The last-named village stands close behind a low beach at the head of a bay which affords the best landing on the north side of the island. Consequently, Capellas has become the headquarters of a whaling industry and a favourite summer resort of the Azorean gentry.

Western S. Miguel. The whole of western S. Miguel has less than 15,000 inhabitants. The only inland settlement is Sete Cidades, a long, straggling village, with a church and school, situated amongst the woods and cultivated fields of the floor of the great caldeira. All the other settlements are on the lower flanks of the crater beside or close to the main coastal road, usually at a few hundred yards from the cliff-tops. These coastal villages are nothing more than a long line

of detached cottages, many of which face away from the road. The population of the six parishes comprising western S. Miguel is small, the largest being Bretanha with 3,500 people and the smallest Candelaria with 1,300 people. The village of Mosteiros (1,700 in parish) differs from the other settlements as its houses are scattered over a low, flat platform at the foot of the steep, coastal slopes.

Industries

Quarrying and Manufacturing. Basalt, for the building of houses and walls, is quarried at many places in S. Miguel. The stone being used in the breakwater extension at Ponta Delgada is brought by rail from a large quarry west of the town.

Manufacturing is little developed on the island, although there is a small export in most years of pottery, cotton fabrics, spirits, and straw hats. The largest concerns are at Ponta Delgada; they include an ice-plant, a brewery, a cannery for pine-apples, a tobacco factory, a large flour-mill (for wheat and maize), a sugar factory (using beet and having a capacity of 3,000 tons a year), and a saw-mill which mostly uses a soft fir, locally grown. In addition, there are an alcohol distillery (from sweet potatoes) and a pottery or terra-cotta works at Lagoa, a tea-preparing concern near Maia, and several grain-mills and a few looms making coarse linens at Ribeira Grande. The latter town is also the centre of the local manufacture of small agricultural implements. In some parts of S. Miguel much of the clothing and household stuffs is still made on hand-loom, and there is also a small industry in embroidery and drawn-thread work.

The factories of S. Miguel, apart from those which use hand labour only, are run on imported coal, the few hydro-electric stations being concerned with lighting. There are some water-driven mills and a few windmills of crude construction, but most of the grinding of grain in rural areas is done by ox-power mills and in hand-mills.

Agriculture

Utilization of Land and Land-tenure. The great majority of the people of S. Miguel get a living from farming and fishing. As a rule, the soils are extremely fertile and yield abundantly. Since the rainfall is usually sufficient, the main control of agriculture is the slope of the land, which is most favourable and consequently needs least terracing on the central section of the island and on the lower hill-slopes near the coast. The mild climate allows the cultivation of almost any product of the temperate and torrid zones, but it has disadvantages in

so far as it equally favours the various insect pests and fungoid diseases which attack crops, most of the imported plants having at one time or another been either completely or partly destroyed by disease. All vegetables and cereals grow well, and some of the land will yield three or four crops a year without irrigation. Hence it happens that the agriculture of S. Miguel depends for its prosperity more on freedom from disease and from the competition of other markets than on the overcoming of natural difficulties.

Most of the farms are small and primitive, except in a few cases where land-owners have been abroad and have adopted foreign methods. The square hoe is preferred to the spade and the basket to the wheelbarrow; grain is cut with the sickle and is beaten or trodden out on threshing-floors and winnowed in the wind. Much of the field work is done by women and children. Whereas terracing is not undertaken on such an elaborate scale as in Madeira and the Canaries, the peasants have expended much labour in constructing or planting wind-shields around many of their plots and orchards. These consist either of trees and shrubs or rough walls of basalt, the latter being usually 6 to 8 feet high and in places even 14 feet high. In the neighbourhood of Ponta Delgada these walls are often plastered and whitewashed and have a cut-stone coping on the top.

Much of the land is held on an almost feudal tenure under conditions which are apt to discourage its improvement. Although most of the farms are small, some of the estates or land-holdings are of an immense size. The systems of land-tenure include the perpetual leasehold (*aforamento*), in which the rent may be paid either in kind at the end of each successive crop or in cash at the end of each determined year. This rent is fixed and unalterable and the lease hereditary. Other land-tenures in use are the freehold, the limited leasehold, the part interest in the produce only of an indivisible estate vested in one of several co-proprietors, and the communal right of property belonging to divers proprietors or parishes.

Chief Crops. The mainstays of peasant agriculture are maize and broad beans; of secondary importance are wheat, barley, sugar-beet, potato, and the sweet potato.

Maize bread is the staple diet of the islanders. The plant grows luxuriantly and is ready for harvesting by August. The cobs are then stripped of their leafy covering except for two or three pieces sufficient to tie them into bundles of 20 or more. The bundles are then threaded one above the other on poles, 16 to 20 feet high, erected in a pyramidal fashion (Photo. 99). These bright yellow pyramids are to be seen in



99. *Stacks of maize cobs, S. Miguel*



100. *Glass-houses for pine-apples, Ponta Delgada*



101. *Tea plantation, S. Miguel*



102. *Stripping a whale at Capellas, S. Miguel*

the yard of nearly every cottage, where they are placed in groups of a dozen to twenty. When thoroughly dried the maize is either taken down and stored before winter commences, or is removed as required from the stack.

Other cereals grow well, the chief being wheat and barley, which, together with maize and beans, were exported to Portugal during the nineteenth century. To-day the island is practically self-supporting in breadstuffs.

In addition to beans, the leguminous crops include lupine which is occasionally grown as a rotational fertilizer alternating with cereals.

The chief fruits are the pine-apple, grape, banana, apricot, orange, lemon, fig, apple, pear, peach, and strawberry. The pine-apple, which forms the chief and only important export of S. Miguel, is grown mainly on the south side of the island near Ponta Delgada, Lagoa, and Vila Franca do Campo. Some of the plantations are extensive and modern in methods. The pines are matured in glass-houses, which require no heating and are always well whitewashed with lime in summer (Photo. 100). The plants are brought to blossom at the same time by a process of smoking, which causes an earlier as well as a more simultaneous harvest. The fruit comes to perfection in two years and may exceed 8 lb. in weight. Wrapped in cellophane or packed in crates, the fruit in normal years is taken to the European market by a fleet of vessels owned by the growers. The trade, which began about 1868 when 427 pines were exported, now deals with 2 million pines in a good year, Germany being the chief customer. The number of pines exported in 1939 was $1\frac{1}{4}$ million and represented a fall of over half a million on the 1938 figures. Subsequently owing to the war-time lack of a market, factories with a capacity of 6,000 to 7,000 tins a day were set up to preserve the fruit, but it appears that the venture has not met with much success.

The vine grows well in S. Miguel, especially in the south, and in the eighteenth century over 20,000 pipes of wine were being produced annually. About 1853 the vineyards were devastated by disease (*Oidium Tuckeri*) and the recovery from this setback was slow. To-day the production is estimated at between 10,000 and 12,000 pipes per annum. The best wine comes from Caloura, a hamlet on the hill-slopes south of Agua de Pau, but since the quality does not reach the standard required by foreign residents, the produce is consumed by the islanders themselves. The most popular wine is a red variety which contains little alcohol.

Between 1750 and 1860 the vine and the orange were the mainstays of the agriculture of S. Miguel. The orange flourishes exceedingly, the trees reaching an abnormal size. The groves, which consist of rectangular plots enclosed by tall basalt walls or by wind-breaks of trees, are found mainly in the central section of the island and near Vila Franca. The oranges of S. Miguel were long valued in the English market, the luscious fruits having rinds no thicker than a wafer and not the vestige of a seed. The exports began with 4 boxes in 1751 and rose in 1802 to nearly 40,000 boxes to London alone. About the middle of the nineteenth century 500,000 boxes, each containing 350 to 400 oranges, were being sent to the English market and represented the staple export of the island. An insect pest appeared later, and within a few years nearly one-third of the trees in the island had been uprooted. In 1877 another formidable disease attacked the fruit and rendered much of the harvest unsaleable. Within the next decade the sales dropped to one-quarter of the former total and the S. Miguel orange was ousted from the English market by its Mediterranean rivals. To-day the Azorean growers cannot compete profitably in European markets.

The cultivation of the lemon was never as extensive as that of the orange. The export began with 4 boxes to England in 1747 and had grown to 7,000 boxes a year within the next 50 years. The trade, however, virtually ceased in 1838, although the lemon and the tangerine are still cultivated on a small scale and yield abundantly.

The list of crops formerly important and now almost neglected is a long one. The sugar-cane was extensively cultivated, especially near Vila Franca, in the sixteenth century. Shortly afterwards it was crippled by outside competition; to-day it has been replaced by the sugar-beet, which supplies the island's requirements of sugar. In the middle of the seventeenth century woad was planted on a large scale, but its prosperity was as short lived as that of the sugar-cane. On the other hand, new crops have been continually introduced. New Zealand flax (*Phormium tenax*) is grown on a small scale, while the tea-plant, introduced about 1878 under the direction of Chinese, now grows in several places on the northern side of the island and produces a surplus for export to Portugal. The main tea-plantations are near Maia, where a factory for preparing the tea, of both green and black varieties, is situated. Much of the picking is done by women and children (Photo. 101).

Among other crops are flax; chicory; hemp, which grows mainly in the west; figs, of which the trees reach an unusual size; coffee, which

flourishes but is only privately cultivated; and tobacco, which is planted mainly on the north side of the island. When the manufacture of tobacco was officially permitted in the Azores in 1864, there was a large increase in the acreage under the tobacco plant, which was not grown elsewhere in the Azores.

Livestock. Meat, other than occasional pork, enters little into the diet of the Azorean peasant. S. Miguel, however, has a considerable number of cattle, goats, and swine, as the following official returns indicate.

Livestock, 1935

Cattle	36,986
Sheep	9,720
Goats	13,269
Swine	24,609
Horses	1,934
Mules	1,128
Donkeys	3,997

Much of the haulage is done by oxen, but in places even sheep are harnessed to draw small carts for light deliveries. The climate is well suited to dairy cattle. The main summer pastures are on the Achadas das Furnas, where the beasts are tended by herdsmen who carry long poles instead of whips. Goats' milk, together with the cheese made from it, forms an important part of the diet of the inhabitants of the island. Not many sheep are reared and the production of wool is small (about 4 tons in 1940). This is used in the making of home-spun cloths. The peasants keep many fowls (207,000 in 1935) and occasionally a few geese, turkeys, and pigeons.

Fishing

There is a considerable fishing industry around S. Miguel, several thousand fishermen being engaged. The vessels used along the coast are strong four-oared boats well suited to rough water. The boats may carry a sail and are usually painted black or dingy-red; the oars are from 15 to 20 feet long and are manned by two men each. Very few of the fishing-craft have motors.

The total fish-catch of the Azores in 1941 was 7,187 tons, the chief species being horse-mackerel (4,252 tons), tunny and albacora (668 tons), and bonito (548 tons). It is highly probable that about half of this catch was landed at ports in S. Miguel. The variety of fish sold in the market at Ponta Delgada is remarkable, but does not obviate the need for a considerable import of cod. Sometimes the appearance in these waters of a basking shark scares away the smaller fish; the

fishermen then apply themselves to the capture of dolphins and of other oil-yielding fish, which are driven inshore and slaughtered, the flesh being melted down for oil.

Capellas in northern S. Miguel is the whaling centre of the Azores. In 1941 the industry employed 474 men and 22 ships, and the catch was 366 cachalots yielding a total of 1,097 tons of oil and 90 lb. of ambergris. The chief cachalot frequenting these waters is the spermaceti whale, which is pursued by boat and captured by means of hand harpoons (Photo. 102).

Ports

There are several small harbours suitable for local fishing-craft in S. Miguel. On the north coast the chief fishing-centres are Capellas, which has a small natural basin about 5 yards wide at the entrance, and Porto Formoso (Photo. 104) and Rabo de Peixe, both of which have a small slipway. On the south coast there is a small quay on the eastern side and a small slipway on the western side of Lagoa bay, and a basin capable of accommodating vessels up to 80 tons at Vila Franca do Campo. The latter place also has a small quay with steps where 20-ton launches can go alongside during fine weather. The only harbour used by large vessels is at Ponta Delgada.

PONTA DELGADA (Lat. $37^{\circ} 44'$ N., long. $25^{\circ} 40'$ W. Population 18,022 in 1930).

General Description. Ponta Delgada is the principal town in the Azores, the seat of the military and naval commands, and the administrative centre of the eastern district which includes the two islands of S. Miguel and S. Maria. The town occupies the central point of the south coast of the hilly 'waist' of S. Miguel and so is well placed with regard to the main agricultural lands and the most densely populated parts of the island (Fig. 47). Since the coast near the town is for the most part cliffed and rocky, the harbour is entirely artificial (Photo. 105). The present built-up area of Ponta Delgada faces the coast for about 2,000 yards and stretches inland for about half a mile. The land behind the port is low but hilly and rises gradually to the main watershed, which attains 1,000 feet about 4 miles to the north. The main commercial section of the town lies near the harbour and merges inland and alongshore to residences and thence to farms and pine-apple plantations. Most of the houses are two or three stories high, substantially built of lava, with very thick walls and tiled roofs.



103. *Povoação from the east*



104. *Porto Formoso, S. Miguel*



105. *Ponta Delgada from the east*



106. *Ginetes, S. Miguel*

Some of the exteriors are covered with patterned glazed tiles, but oftener with plaster, whitewashed, except the corner-stones, doorways, and basements, which are of carefully cut basaltic or other volcanic stone of a dark neutral tint. The ground-floor is generally used as storage space; balconies to the first-floor windows, overlooking the street, are common.

The principal streets run from east to west and are fairly wide (Fig. 48). These are crossed by many streets which join the waterfront to the northern suburbs and are often narrow and crooked. Most of the streets are hard-surfaced, some being cobbled and some paved with lava rocks; few of them have good lighting.

The buildings include a number of hotels, cafés, and restaurants. Among the older structures are three churches, one of which (S. Sebastião or S. Matriz) stands near the landing-stage and has a tall, square tower. The public buildings include a prison, a large grey pile of masonry overlooking the sea, east of the harbour, and a large hospital for the islanders, once a Franciscan monastery, which has been enlarged to take 900 in-door patients. Forte de S. Braz, a red-roofed fort with two gables, is now an artillery barracks. On the outskirts of Ponta Delgada there are several imposing mansions, with fine gardens, belonging to members of the nobility.

History. Ponta Delgada remained subject to Vila Franca during the first half-century of its history, but owing to disputes between the two places, the king of Portugal gave Ponta Delgada its freedom in 1499. In 1522, when Vila Franca was destroyed by earthquakes, the seat of the Government was transferred to its rival, which was made a 'city' in 1546 and has remained the capital of S. Miguel ever since. In spite of emigration, Ponta Delgada grew rapidly owing to the fertility of its hinterland. The town, however, was badly placed for purposes of commerce, its open roadstead affording little or no protection to vessels from the south-east and south-west. This drawback was partly remedied soon after 1860, when the Portuguese Cortes authorized the commencement of a large breakwater, towards the cost of which certain revenues and taxes were allotted. The work was started in the following year and, in spite of repeated damage and partial destruction by storms, had by 1876 reached a length of nearly 2,000 feet at low water, and protected a space of about 45,000 square yards against all but south-easterly winds. Soon after this year vessels were able to go alongside the quays and the position of Ponta Delgada as the chief commercial centre of the Azores was ensured. The harbour has been steadily enlarged and forms one of the main engineering



FIG. 48. Plan of Ponta Delgada

1. S. Francisco dock. 2. Fish market and coal depot. 3. Customs house. 4. Tobacco factory.
5. Marconi wireless station

works in overseas Portugal. Because of it Ponta Delgada became the Atlantic headquarters of the American fleet during the War of 1914-1918.

Industry and Commerce. Apart from the industries already mentioned (p. 285), the manufactures of Ponta Delgada include three foundries and machine-shops and three tobacco factories. Most of the various industrial concerns derive their power from electric current (capacity 800 h.p., voltage 120-200) generated by hydro-, steam-, and diesel stations. The hydro-electrical stations serving Ponta Delgada are at Caldeiras near Ribeira Grande and at Agua d'Alto near Vila Franca do Campo.

In 1934 about 262 mechanically driven ships totalling 945,000 tons entered the harbour; in 1938 nearly $1\frac{1}{2}$ million tons of shipping was turned round, the cargo traffic then being about 33,500 tons in and 21,000 tons out. The imports consisted mainly of coal, petrol, oil, and a variety of manufactured goods, including hardware, paint, iron, tin plates, cutlery, machinery, shoes, hats, medicines, and automobiles. The exports were formed largely of pine-apples and smaller quantities of cattle, dairy products, tea, chicory, oranges, beans, potatoes, tobacco, whale oil, alcohol, and embroideries.

Detailed Description. The harbour of Ponta Delgada, the best in the Azores, is sheltered by a breakwater extending about 800 yards eastward and then for about 700 yards to the east-north-east (Fig. 48). The entrance to the harbour, between the shoals on the north and the head of the breakwater, is about 250 yards wide. The inner harbour is well sheltered except from south-easterly winds, and entrance is easy except on the rare occasions when winds blow from east-south-east.

A large fleet could anchor outside the harbour in 20 to 30 fathoms about three-quarters of a mile south of the breakwater. The seaward side of the breakwater is heavily protected by loose blocks of lava along its entire length.

In the inner harbour there are two lines of mooring-buoys in 5 to 10 fathoms of water for vessels under 15,000 tons. Ships are usually moored head and stern with their sterns secured to one of the mooring-buoys. There is accommodation for 7 or 8 ships at the buoys and for 2 ships at the jetties, 5 of which extend a short distance north-north-westward from the breakwater. At the breakwater quay 2 ships drawing 28 feet or over, and 1 drawing up to 23 feet, can be berthed. Vessels, including cruisers, up to 600 feet in length and 30 feet in draught have been accommodated in the harbour.

The wharfage available for shipping in the harbour is approximately as follows:

	<i>Length (feet)</i>	<i>Width (feet)</i>	<i>Depth (feet) L.W.</i>	<i>Number of berths</i>
Breakwater Quay . . .	1,050	..	19-24	3
Coaling jetties (2) . . .	240	15	6	..

Spring tides rise about 6 feet.

The breakwater quay is 5 feet above high water and has 4 sets of 12 steps on its inner side. The coaling jetties are constructed of wood projecting over concrete piles; these jetties are 9 feet above high water and are used only for filling coal lighters. Small craft use the S. Francisco dock and a short quay, with 4 sets of steps, at the customs house just south of the church of S. Matriz.

General cargo is discharged mainly into lighters from ships at buoys. Coal, wheat, and other cargoes at the breakwater quay are handled by cranes on the quay from lighters to lorries or by ships' appliances alongside the lorries. There are several small cranes on this quay as well as a few floating cranes in the harbour.

The harbour craft include a considerable fleet of lighters and of petrol motor-launches, the latter being used for passenger service between ships and the shore. There are several large storage sheds on the breakwater quay.

Several thousand tons of coal are usually kept in stock, coaling being carried out from lighters, which load at the coal jetties on the north side of the harbour. The oil-fuelling berths (for fuel and diesel) cover a space of 800 feet with 7 to 9 fathoms alongside. The total storage capacity of oils is about 27,000 tons (the tanks being west of the town), but the usual stocks are a few thousand tons of fuel oil and 1,200 tons of diesel oil. In addition, fresh provisions and an unlimited supply of water for drinking and for ships' boilers are available.

Port Facilities. Marine repair facilities of a limited nature are undertaken at three foundry and machine shops, one of which is capable of making castings up to $2\frac{1}{2}$ tons. There are three slipways in the inner harbour: that forming the western end of S. Francisco dock is 246 feet wide and is used for hauling up boats and small craft; that in the western corner of the harbour is 33 feet wide and is associated with a repair shop for minor repairs, welding, and small castings; that at the eastern end of the breakwater quay is intended for tugs and large lighters.

Communications. A single-track, broad-gauge (7 ft.) steam railway runs from the end of the breakwater to a large quarry just west of the town. This line has carried blocks of lava and volcanic stone to the breakwater for the last 75 years. The wagons are mostly of iron and will hold 8 to 10 tons.

Ponta Delgada is the chief road centre of S. Miguel. From this town main roads, for the most part motorable and with good surfaces, run to Ribeira Grande (13 miles), Capellas ($8\frac{1}{2}$ miles), and several other places on the north coast. Other roads lead to the western end of the island (Mosteiros, 18 miles) and to the eastern end (Nordeste, 47 miles). The latter road serves Lagoa, Vila Franca do Campo, Furnas, and Povoação, the chief towns of the south coast. Several hundred cars and a few dozen motor buses were licensed in Ponta Delgada during 1940.

By sea, the *Emprêza Insulana de Navegação* runs fortnightly services to Madeira, Lisbon, and, when the weather permits, to other islands of the Azores, except S. Maria, which is visited once a month. This and other steamship connexions are described on pp. 104-105. In fine weather sailing-vessels of 20 to 50 tons with motors make inter-island trips with passengers and freight.

Ponta Delgada has communication by submarine cable with Lisbon and Horta, where connexions exist to most parts of the world. There are two radio stations in the town, one for public correspondence, the other for government and commercial services to Madeira and Portugal (Appendix D). The city is served by public telephone and by telegraph, the latter system extending outside the city to most of the towns and villages of S. Miguel.

Communications

The short stretch of railway described above is the only track in S. Miguel. The island is fairly well served by roads, the construction of which is greatly assisted by the peripheral distribution of the towns and villages. The road network consists mainly of a circum-island road and of nine routes across the island (Fig. 47). Most of the main roads are fit for motor traffic, but heavy traffic would soon seriously cut up the road-surfaces that are not paved. The best and most modern road in the island is that from Ponta Delgada to Ribeira Grande which is paved throughout and has an ample double-track width. The other roads are only paved in short stretches, and their surface usually consists of a mixture of gravel, earth, and stones. The roads are well graded, but those which are not completely metalled

become muddy in winter, although the permeable volcanic subsoil prevents them from becoming impassable.

The motor transport in use on S. Miguel during December 1940 consisted of 140 taxis, 370 private cars, 80 motor-buses, 12 trucks (lorries), and 90 motor-cycles. Omnibus services run between all the main towns and between Ponta Delgada and its suburbs. There is still a considerable amount of transport by ox-cart. In Ponta Delgada, Vila Franca do Campo, and Ribeira Grande the streets are carefully paved with shaped-stone blocks about the size of bricks.

The main roads of S. Miguel are described in the following account. Apart from these routes, most of the tracks are steep and, except in the south-eastern corner of the island, are of little economic importance.

Eastern S. Miguel

The road network of eastern S. Miguel consists of a south coast road, a north coast road, and a road crossing the island from Maia to Furnas. The former really commences at Ponta Delgada and continues round the eastern end of the island, where it joins the north coast route (Fig. 47).

Ponta Delgada-Vila Franca-Nordeste. This road is 47 miles long. Its surface consists mainly of earth and gravel on a rock foundation, but some stretches are paved. Its present condition is fair, except between Vila Franca do Campo and Furnas, and even this stretch is practicable for cars. The journey throughout is hilly, especially near Furnas and Povoação, and there are numerous sharp curves and hair-pin bends at the crossings of gullies and mountain spurs. The gullies, about 43 in number, are adequately bridged for 3-ton traffic.

At Ponta Delgada the road passes through the eastern suburbs, skirting Calhetas, a small fishing-cove just west of the gasworks. It then passes the prison and, beyond the fork to Ribeira Grande, the chief flour-mill and bakery of Ponta Delgada. The road continues to wind along the coast to the cable station and immediately beyond it to the church of S. Roque (3 miles). Thence houses are spaced on both sides of the route as far as the church at Livramento ($3\frac{3}{4}$ miles), where a branch road leads north-eastwards to Ribeira Grande.

At Livramento the Vila Franca route turns towards the coast and descends to Lagoa (6 miles). About 100 yards beyond the church the road forks, the north branch leading to Ribeira Grande and the east fork along the coast. The latter takes an undulating course to Agua de Pau ($10\frac{1}{2}$ miles), bridging two earthy gullies about 30 feet deep and

50 yards wide. Just beyond the main church at Agua de Pau the road narrows for a short stretch. About a mile from the outskirts of the town the route descends steeply to the coast, which it continues to follow closely, especially between Ribeira Chã and Roida da Praia, where it is confined between steep hill-slopes and the sea. Near Roida da Praia ($13\frac{1}{2}$ miles) there is a bridge over a rocky gully about 80 feet deep and 100 yards wide. Eastwards the road descends gently to Agua d'Alto (15 miles) and, after crossing another deep gully, proceeds over flat, fertile country to the main square of Vila Franca do Campo (16 miles).

Beyond Vila Franca there are two roads to Furnas; the one along the coastal strip and the other, a more difficult route, along the middle hill-slopes at from 1 to 2 miles from the sea. The two join east of Ponta da Garca (at 23 miles) and descend with a steep gradient to the floor of the valley that drains into the southern end of Lake Furnas. The road surface on this stretch is poor. The route proceeds along the eastern shore of Lake Furnas through wooded country and traverses the fields and farmlands near Furnas ($28\frac{1}{2}$ miles).

East of Furnas the road makes a winding ascent over forested mountainous country to a watershed at about 1,000 feet, south of which it descends sharply, with numerous hairpin bends and at least five steep gradients, to the coast at Povoação ($35\frac{1}{2}$ miles).

At this town the road turns north-eastwards and climbs the mountain-slopes to its summit-level of 2,700 feet at a spur of the Pico Verde. The ascent is especially steep on the spur just north-east of Povoação and on the approach to the divide near Pico Verde. Thence the descent to Nordeste (47 miles) lies over bleak, almost uninhabited hill-slopes, the gradients being steep and the road tortuous. From Nordeste the road continues along the north coast to Ribeira Grande.

Ribeira Grande-Nordeste. The north coast routes of S. Miguel meet at Ribeira Grande. That to the east of the town runs for 30 miles to Nordeste. It takes for the most part a very winding course at an average height of about 700 feet and at 500 to 1,500 yards from the coast. It touches sea-level only at Porto Formoso and Maia. The main natural obstacles are gullies, of which nearly sixty occur, all crossed by stone bridges sufficient for 3-ton traffic, and mountain spurs which necessitate many curves and sharp turns but do not cause exceptionally steep gradients.

After leaving the eastern suburbs of Ribeira Grande the north coast road crosses undulating farmlands to Lameiro ($2\frac{1}{2}$ miles), where it enters wooded and mountainous country. At 4 miles the route

descends steeply with two sharp turns to the seaboard at Porto Formoso (6 miles), and, after a short journey along the upper edge of the steep coastal slopes, returns to the sea again at Maia (8½ miles). The country east of Maia is deeply dissected by several gullies which force the route to turn inland and necessitate the use of several steep descents and numerous hairpin bends. Beyond Fenaes d'Ajuda (15 miles) the route changes little in character, keeping within a short distance from the sea at an altitude of about 700 feet. The crossing of narrow valleys gives rise to sharp turns and to fairly steep gradients, the chief being at Salgo (17 miles), Achadinha (19 miles), Nordesteinho (25 miles), and Nordeste (30 miles).

Maia-Furnas. About three-quarters of a mile west of Maia a fork from the Ribeira Grande-Nordeste route leads over the mountains to Furnas. The road is nearly 7 miles long, and throughout this distance has a good surface owing to recent improvements made for the new Furnas Lake Hotel.

From the coastal route near Maia the Furnas road climbs inland across highly cultivated country, rich in natural and agricultural vegetation. The route often lies between high wind-breaks of hydrangea. The gradual ascent terminates in the flat, heathery moorlands of the Achadas das Furnas, one of the chief grazing regions of S. Miguel. At the eastern end of this moorland the route drops very steeply from 1,700 feet to 700 feet at Furnas. From Furnas a route, 4 miles long, with tunnels through a mountain ridge, leads southwards and terminates at the coast at Ribeira Quente. This road was under construction in 1941, when it was being made 16 feet wide with a dirt surface; the tunnels are 272 feet and 439 feet long respectively and 22 feet high.

Central S. Miguel

The road network of central S. Miguel consists mainly of routes radiating northwards from Ponta Delgada and of a northern and a southern coastal route (Fig. 47).

In the south the coastal route joins Lagoa with Ponta Delgada (p. 295), whence it is continued westwards to Relva and Mosteiros. On the north the coastal road joins Ribeira Grande with Capellas whence it proceeds westwards to Mosteiros. The main trans-island routes are as follows:

Ponta Delgada-Ribeira Grande.

Ponta Delgada-Livramento-Ribeira Grande.

Ponta Delgada-Pica da Pedra-north coast road.

Ponta Delgada-Fajã de Cima-Fenaes da Luz.

Ponta Delgada-Capellas.

Lagoa-Ribeira Grande.

These routes have certain features in common: they seldom, if ever, exceed 1,000 feet, and consequently have easy gradients; streams and bridges are rare or absent; they traverse rich agricultural land, being in parts hemmed in by forest plantations and in others by tall walls of volcanic stone or by tall thick wind-breaks of trees. The main connexions and topographical features of these routes are outlined below.

Ponta Delgada-Ribeira Grande. This is the best and most modern road in S. Miguel, being paved and having ample double-track width throughout its length. It branches off north-eastwards just beyond the prison at Ponta Delgada and ascends on a gentle gradient, passing close to Fajã de Baixo. The road traverses short stretches of scrub-land and of forest plantations on both sides of the watershed, which lies at about 700 feet.

At the southern outskirts of Ribeira Secca (12 miles) the main road is joined by the road from Livramento to Ribeira Grande. A short distance north of this junction, near the church at Ribeira Secca, the route turns abruptly eastwards to Ribeira Grande (13 miles). In Ribeira Grande the road crosses two bridges over a deep, stony gully which is often dry. The alinement of this modern road as shown in Fig. 47 is approximate only.

Ponta Delgada-Livramento-Ribeira Grande. This road has a fairly good surface of gravel, earth, and stone over a rock foundation. It has no steep gradients and crosses no watercourses. At the church at Livramento on the Ponta Delgada-Vila Franca road (p. 296) the road to Ribeira Grande turns north-eastwards and climbs steadily, passing at first between houses and later through plantations mainly of pine and other conifers. About $2\frac{1}{2}$ miles beyond the church at Livramento a road comes in on the east from Lagoa. The watershed is crossed at about 670 feet and beyond it. After some miles of woodland the country becomes agricultural. At $7\frac{1}{2}$ miles a minor road branches to Rabo de Peixe, and at 10 miles the Lagoa-Ribeira Grande road comes in on the right. At this point the main road turns sharply northwards to Ribeira Grande (13 miles).

Ponta Delgada-Pica da Pedra-North coast road. This trans-island route is only 8 miles long, but is practically never used by motor traffic as its surface, of earth and gravel over a rock foundation, is extremely rough beyond Fajã de Baixo. The gradients are easy and

there are no bridges. The road serves Fajã de Baixo (2 miles) and then ascends gently, with one sharp turn (at $4\frac{3}{4}$ miles), to about 820 feet before descending to the long straggling village of Pica da Pedra ($6\frac{1}{2}$ miles). Junction is made with the north coast road at a point about $1\frac{1}{4}$ miles west of Rabo de Peixe.

Ponta Delgada-Fajã de Cima-Fenaes da Luz. This road, the shortest trans-island route in S. Miguel, is not often used by motor traffic. It is 7 miles long and has a poor surface of gravel, earth, and stone over a solid foundation.

The road leaves Ponta Delgada by the route to Capellas, from which it branches northwards at the northern outskirts of the capital. It ascends gradually to the straggling village of Fajã de Cima (2 miles), beyond which agricultural country is reached. At about 5 miles from Ponta Delgada the road crosses the watershed near Pico Grande by means of a gradient of 1 in 7 and a cutting. The summit height is about 850 feet. North of this point the road descends steeply for about half a mile and then drops gradually to the coast at Fenaes da Luz (7 miles).

Ponta Delgada-Capellas. This road, $8\frac{1}{2}$ miles long, is surfaced with gravel, earth, and stone over a solid foundation. It has no difficult gradients and no sharp turns.

The road forks left from the route to Fenaes da Luz on the northern outskirts of Ponta Delgada and proceeds over agricultural country to the centre of the island (4 miles). Here it passes at about 950 feet between two hills, Serra Santos on the east and Serra Gorda on the west. Beyond the gap a gradual descent, in part through low woods, leads to Capellas ($8\frac{1}{2}$ miles). An alternative road, which lies about 1 mile to the west and which takes a fairly direct course over slightly undulating country dotted with isolated cones of basalt, also links Capellas with Ponta Delgada.

Lagoa-Ribeira Grande. In a course of 8 miles this road crosses no streams and has no steep gradients. From Lagoa the route runs northwards and is confined between high stone walls as far as Cabouce ($1\frac{1}{2}$ miles). Beyond this village the country becomes more open and in parts is grassland. At $3\frac{1}{2}$ miles a road from Agua de Pau comes in from the south-east. From this point the Ribeira Grande route descends gently through agricultural country to its junction with the new main road from Ponta Delgada to Ribeira Grande.

Western S. Miguel

The western part of S. Miguel has few roads, the bulk of its population being adequately served by a coastal road. There is in addition



FIG. 49. Terceira

a road leading from Ponta Delgada to the rim of the Caldeira das Sete Cidades, the construction of which allows tourists to visit the great crater (Fig. 47).

Ponta Delgada–Mosteiros–Capellas. This road serves the villages on the cultivated lower slopes of the Caldeira das Sete Cidades. For the first 8 miles it is straight and climbs gently to the steep spurs of the Caldeira, which it then proceeds to skirt and cross at between 100 and 400 feet. Beyond Feteiras ($8\frac{1}{2}$ miles) there are many curves and bridges as the road winds in and out of small valleys and gullies. As far as Mosteiros (16 miles) there are at least thirty-two gullies, all of which are crossed by stone bridges adequate for 3-ton traffic. In this stretch the main difficulties are a short defile between the mountain slopes and the sea at Candelaria (11 miles), a sharp ascent into Ginetes (14 miles; Photo. 106), and a steep descent with hairpin bends to the village of Mosteiros (18 miles). Throughout the whole distance from Ponta Delgada the road is in good condition.

Beyond Mosteiros the route retains much the same characteristics for the next 18 miles to Capellas. Throughout this stretch the road runs above low cliff and winds in and out of many small valleys and gullies. The route passes seven villages and is lined with houses for much of its length. The surface is well engineered, some parts being paved and all the thirty gullies crossed being adequately bridged.

From Capellas the road continues as the main coastal artery to Fenaes da Luz, Rabo de Peixe, and Ribeira Grande. These 12 miles form the most direct road in S. Miguel.

Ponta Delgada–Caldeira das Sete Cidades. This road is 14 miles long. It is adequately metalled for light traffic, but has several steep gradients and many hairpin bends. From the north-western suburbs of Ponta Delgada the road ascends gently for 5 miles through cultivated and well-populated country. It then climbs steeply, especially at 6 to 7 miles from Ponta Delgada (1 in 5) and again near Lagoa Carvao (1 in $4\frac{1}{2}$) and Lagoa Pau Pique (1 in 4). Having climbed to 1,800 feet, the road proper terminates at the lip of the crater (14 miles). A bridle path descends steeply to the village of Sete Cidades, which lies on the floor of the crater, 1,000 feet below.

TERCEIRA

TERCEIRA is an oval-shaped island, about 19 miles long by 10 miles broad, and has a total area of 153 square miles. The island is smaller in size than S. Miguel or Pico, but in number of inhabitants it is only surpassed by S. Miguel.

Some unknown mariners sighted the island by chance between 1445 and 1450, and it was first called the Island of Jesus Christ, having for arms the crucifix. As it was the third island of the Azores to be discovered it was later given the name of Terceira.

PHYSICAL GEOGRAPHY

Relief

This compact island can be divided into three parts. In the east, the oldest part, there is an almost circular plateau, about 1,000 to 1,150 feet high and about 4 miles in diameter (Fig. 49). This is a flat open moorland, on which are a few hills, bounded on the east and north-east by a steep ridge, the Serra do Cume da Praia, which rises to 1,800 feet. To the south the plateau falls quite steeply to the sea. To the north and north-east of the plateau is a narrow lowland, about 300–400 feet in altitude, at the south-eastern end of which is the port of Praia da Victoria. Beyond this plain low hills run parallel with the coast and form the north-eastern corner of the island.

The central part of Terceira is more complicated but can be divided into two areas. In the south is an old crater, the Caldeira de Guilherme Moniz, nearly 2 miles across with steep walls especially on its southern side. North of this caldeira is a confused mass of volcanic hills with numerous crater lakes. The highest peak in this area is Pico Alto (2,647 ft.).

The western third of the island, the newest part, is dominated by the volcano of S. Barbara (3,356 ft.). Smaller cones are found on the sides of the larger mass (Photo. 107). The volcano drops steeply to the sea on the west, south, and north, but on the east it is joined to the central volcanic area by a high plateau (1,600 ft.), on which a few volcanic cones rise above the general level. This plateau is crossed by the road from Angra to Altares and Biscoutos.

The interior of Terceira, although mountainous, has been described as the least rugged of the Azores. The existence of three extensive level areas, first the plain round Lagens in the north-east, second the



107. *Caldeira de S. Barbara*



108. *Monte Brazil, Terceira*



109. *Coast of Terceira near Ponta da Mina*

plateau round Ginjal in the south-east, and thirdly the plateau east of S. Barbara, differentiates Terceira from most of the other islands.

Drainage and Water-supply

In the east the Serra do Cume da Praia is the source of numerous streams which flow to the Baia de Praia, but the mountains are not deeply cut. North of Angra three streams come down from the Caldeira de Guilherme Moniz and reach the sea in or near the town. Good supplies of water are available at Angra and at Praia, but an outbreak of typhoid fever at Angra in 1919 was attributed to contaminated water. The northern, western, and southern slopes of the caldeira of S. Barbara are deeply dissected by a large number of streams.

Vegetation

Terceira was once covered with a thick mantle of vegetation and parts of it were heavily timbered. At the present time, owing to the destruction of past centuries, very little woodland remains. A large proportion of Terceira is flat and fertile and considerable parts of it are under cultivation. The countryside consists of a patchwork of innumerable fields separated by stone walls.

In Terceira, as in the other islands, the original Portuguese and Flemish settlers used the available timber in reckless fashion. Nevertheless Van Linschoten, writing at the end of the sixteenth century, remarked that 'the island hath great store and excellent kindes of woode, especially cedar [juniper] trees, which grow there in so great numbers that they make scutes, cartes and other grosse workes thereof'. There is no doubt that the trees of the original woodland were large in size. All the old churches and other buildings are roofed with 'cedar' wood, and tradition has it that the immense beams in the roof of the cathedral at Angra were cut from trees that flourished as late as 1570. The early eruptions overwhelmed parts of the original woodland, and in several places in Terceira large juniper trees are dug up from time to time and found to be in perfect preservation. These unearthed logs are welcome finds and are promptly cut up for use as firewood, a commodity which is now very scarce in Terceira.

On the higher parts of the island, notably on the slopes of S. Barbara, the zone of cultivation extends to at least 1,000 feet, but that height does not represent the limit of man's destruction of the original forests, since on the higher slopes, where doubtless the forest once grew, only scrub is now to be found.

Scrub is formed of juniper and ling (*Calluna vulgaris*). The latter occupies the lower slopes of S. Barbara below 2,200 feet where the ground is dry and the soil poor and stony, and it is accompanied by *Thymus serpyllum* in its dense-growing, trailing, narrow-leaved Azorean form. The juniper predominates on the higher slopes, where the ground is wet and often boggy, and where *Sphagnum* and *Polypodium* thrive.

Only small patches of woodland now survive in the island. Three miles north of Angra on southward-facing slopes are some scattered areas of woodland. Another large area exists south-west of Agualva, and other detached portions of wooded country are found near the coast in the north-west of the island.

Coasts

The oval outline of Terceira is formed in the west and north-west of steep cliffs, with more gently sloping shores in the south and east. There are two bays which are used as harbours. In the south is the Baía de Angra, on the east side of the volcanic peninsula of Monte Brazil (Photo. 108), while on the east is the Baía de Praia in the shelter of Merenda point.

The east coast between Ponta do Espartal and Ponta das Contendas, about 15 miles long, has steep cliffs in the north, with a lower coastline in the south (Photo. 109). The main anchorage is in the north-west off the Baía de Praia and the small town of Praia da Victoria; a sandy beach extends round the bay, and the land rises gently behind it. Landing is also possible at Porto Novo, a small cove at the mouth of a stream which enters the sea south-west of Ponta Biscoitos.

The southern and western coasts from Ponta das Contendas to Ponta da Serreta (24 miles) are regular in outline, except for the peninsula of Monte Brazil. East of Angra there is a landing-place in a rocky bight which lies below Salga and is used by fishing-vessels, and another below Porto Judeu. The town of Angra do Heroísmo stands on a bay between Ponta Val and Monte Brazil and extends across the head of the peninsula. The coast of the bay is low, except for the abrupt cliffs of Monte Brazil (672 ft.) which command the harbour. There are several jetties for landing, the largest being the Customs House jetty in the middle of the waterfront. Landing is possible at two points on the Baía do Fana, on the west side of Monte Brazil, and there is a jetty at S. Matheus, a small village $2\frac{1}{2}$ miles west of Angra. The west coast is steep, and landing is not possible except at a break in the cliff near Ponta das Ribeiras, between two of the streams which

come down from S. Barbara. This landing can generally be used in summer. Steep cliffs, dissected by numerous torrents, continue along the whole of the west coast.

The northern coast consists mainly of cliffs with alternating headlands and bights. Landing is not easy on this coast, but there are three small coves where it is possible. The first lies 2 miles east of the conical hill of Mathias Simão; the second is below the village of Biscoutos, where there is a jetty at the head of a boulder-strewn bay, and the third is east of Ponta da Vila Nova. All these points are within a short distance of the main coastal road.

HUMAN GEOGRAPHY

Distribution of Population

The population of Terceira in 1930 was 48,380, with a density of 316 persons per square mile. The number of inhabitants is larger than that of any of the other islands except S. Miguel, but the density is lower than those found in S. Miguel, Graciosa, and Fayal. However, the density figure for Terceira is very misleading, as the whole of the centre of the island is uninhabited, the population being distributed on coastal areas (Fig. 49). The inhabited area covers only about a third of the island. In 1930 the 562 foreigners resident in Terceira included 289 Americans and 247 Brazilians.

Of the total population 10,642 reside in Angra do Heroísmo, and Praia da Victoria contains 3,096. These two coastal towns together have more than a quarter of the island's population.

Angra do Heroísmo is on the centre of the south coast and was until 1836 the administrative capital of the whole group of islands. Angra is still the cathedral city of the Azores and the capital of one of the three districts by which the group is now administered. It has been described as the most characteristic and interesting town in the Azores. With its massive ancient fortifications, ornate houses, old mansions, and monasteries it still retains an appearance of antiquity. The chief buildings in the town are the cathedral and the old castle of S. João Baptista, built by the Spaniards in 1591. The small white-washed houses in the upper part of the town have large pyramidal chimneys (Photo. 110).

On the east coast is Praia da Victoria (3,096), the second largest town in the island. This place was destroyed by earthquake in 1614 and again in 1841, and so it contains few ancient buildings. In 1829 the Miguelist fleet was defeated in the bay in front of the town by the

Count of Villa Flor, who received the title of Duke of Terceira, and 'da Victoria' was added to the name of Praia.

One of the most densely populated parts of the island is the plain in the north-east which lies behind Praia da Victoria (Photo. 111). About 8,000 people are found in this area, including those in the parish of Lagens (2,985). The coastal areas to the east and west of Angra are well populated. To the west of Angra are the villages of Terra Cha, S. Bartholomeu, Nossa Senhora do Pilar, S. Barbara, and Doze Ribeiras, with a total population of about 9,000 persons. To the east of Angra another line of coastal villages from Ribeirinha to Porto Judeu contains about 7,000 persons. In the south-eastern corner of the island is the small town of S. Sebastião (over 2,000 population), to the north of which are a number of small villages.

The north-west coast has a line of villages from Raminho on the west to Quatro Ribeiras on the east, with a total population of over 5,000. The most thinly peopled part of the coastal belt is in the north-west of the island, between Doze Ribeiras and Raminho, and has a population of less than 1,000.

Industries

The principal occupation of the people is agriculture, and pastoral industry is strongly developed. A considerable quantity of maize is produced as well as wheat, beans, and other vegetables. The island is also the centre of sugar-beet production in the Azores. A certain amount of tobacco is grown and exported, and small quantities of oranges, lemons, and grapes are also produced. Nevertheless, the most important crop is maize.

Terceira is more noted for the pastoral side of agriculture and exports fine cattle and large quantities of butter and cheese. The bulls are fierce animals and are used for bull-baiting. In the spring, bull-baiting, without horses, weapons, or professionals, is carried on in the streets. There is one record of the savage nature of the Terceira breed of cattle. When Philip II of Spain caused Terceira to be attacked in 1581, his troops were routed and driven away by the peasants of S. Sebastião, who massed a number of their ferocious cattle, kept them out of sight until the Spaniards were all on the beach, and then drove them headlong at the enemy, following up the charge themselves, and killing nearly all the invaders and capturing several guns. At the same period van Linschoten described the cattle as 'the greatest and fairest to be found in all Christendom with unmeasurable great and long horns'.



110. *Houses in upper part of Angra do Heroísmo*



111. *Bay of Praia from the west*



112. *Bay of Praia and Praia da Victoria*

The numbers of livestock in Terceira in 1935 are given in the following table:

Horses	1,867
Mules	480
Donkeys	1,269
Cattle	41,625
Sheep	14,847
Goats	6,441
Pigs	19,718

There are more cattle in Terceira than in any of the other islands in the group, but Fayal has more sheep.

Other industries are of minor significance. An embroidery industry, in the style of Madeira, has been introduced. Homespun linens and woollens are manufactured as well as bricks, tiles, and soap. Fishing is carried on from several coastal villages, and there is a fish cannery at Angra.

Ports

Only two harbours of Terceira are frequented by shipping. The one is at Angra on the south side of the island and the other at Praia da Victoria on the north-east. The latter is formed by the Baia de Praia, which is partly sheltered by Merenda point (Photo. 112). It offers an anchorage in 19 to 21 fathoms over sand at about 1 mile off shore; its best landing-place is at a small wharf (with a crane) at the north-east corner of the bay near the town of Praia da Victoria. The former, the Baia de Angra, is by far the chief anchorage of Terceira. West of it there are only two jetties on the south coast: one on the western shore of the Baia do Fana, a cement structure 22 yards long and 9 yards wide, with a double set of steps on its east side; the other, $2\frac{1}{2}$ miles farther west near the village of S. Matheus, is 22 yards long by 3 yards wide, with two sets of steps on the south side. Both of these jetties are lighted by electricity. Both act as feeders rather than rivals of the port of Angra.

ANGRA DO HEROISMO. (Lat. $38^{\circ} 39' N.$, long. $27^{\circ} 14' W.$ Population 10,642 in 1930.)

General Description. Angra do Heroismo is situated near the mid-way point of the south coast of Terceira. The choice of the site was mainly determined by the headland of Monte Brazil, an extinct volcanic crater that rises to 672 feet at its eastern rim (Photo. 114). The headland falls steeply seawards, but declines and narrows northward to a low isthmus about 100 feet above sea-level; it forms with the

adjacent coast two bays, the Baia do Fana on the west and the Baia de Angra on the east. Since the latter bay was the more sheltered, the early settlement was founded at its head. To-day the built-up area extends for half a mile along the curving shore of the bay and the

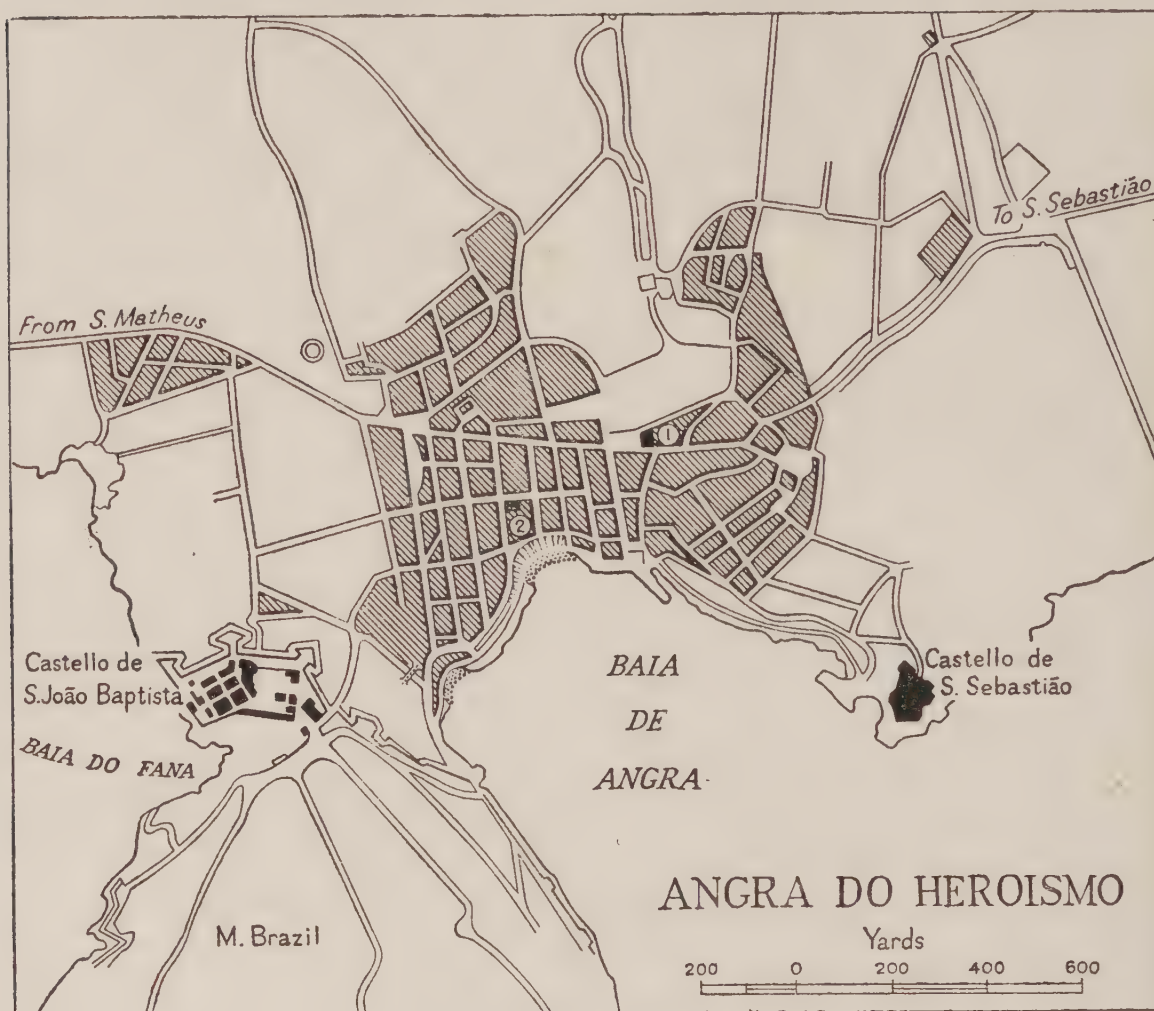


FIG. 50. *Plan of Angra do Heroísmo*

1. *Town Hall.* 2. *Post office and telephone exchange*

western suburbs actually stretch to the Baia do Fana (Photo. 115). The narrow headland formed a suitable site for the Castello de S. João Baptista which, together with a line of fortifications, defended the entrance to the natural fortress of Monte Brazil (Fig. 50).

North of the town the land slopes at first gradually and then steeply to the rim of the Caldeira de Guilherme Moniz, which attains 2,000 feet within $2\frac{1}{2}$ miles of Angra. The hill-side immediately north of the port is covered for the most part with low scrub and patches of woodland.

The houses are well built of stone with tiled roofs; nearly all are of one or two stories only, are whitewashed, and face straight on to the

street. There are about ten principal streets traversing the town in a north-south direction and intersected by numerous minor streets and alleys, some of which are narrow, winding, and steep. The main traffic centre is the square in front of the Town Hall, to which a wide street, the Rue de Lisboa, leads from the waterfront.

Angra with its orderly streets, its decorated house-fronts, its deep overhanging eaves, and its winding alleys near the waterfront is the most attractive town in the Azores. The chief buildings include the Town Hall, with a fine council chamber, the cathedral, and the Castello de S. João Baptista. The modern buildings include two hotels and two small general hospitals. The town is lighted by electricity generated by two diesel stations. A feature of the town life is the holding on certain occasions of bullfights (*tourada a corda*) in the streets, the bull being partly, but by no means wholly, restrained by a rope held by youths.

History. The first colonists of Terceira in the middle of the fifteenth century were mainly Flemish, and Angra was one of their original settlements. Vasco da Gama on his return voyage from India in 1499 took his sick brother Paul to Angra, where he died and was buried in the church of Nossa Senhora da Guia. By 1534 the town was divided into four parishes and it became the capital of the Portuguese colony of the Azores and the seat both of the Captain-General and of the bishop. The town received the addition of 'da Heroismo' to its original name to commemorate its successful defence against the Miguelists in 1829; it served as a refuge for Queen Maria II of Portugal from 1830 to 1832. During the War of 1914-1918 the castle of S. João Baptista was occupied by German prisoners.

Industry and Commerce. There are no important industries in Angra do Heroismo; the few small manufactures include tiles and bricks, domestic weaving and spinning, embroideries, and soap. A little fish-packing is also done, and there is an ice-plant in the town.

During the year 1934 about 152 mechanically driven vessels totalling 226,000 tons entered the harbour of Angra. No statistics are available of the cargo handled, but it would probably not exceed 20,000 tons in all.

The chief exports are butter, cheese, and cattle with small quantities of homespun woollens and linens, embroidery, bricks, and tiles. The main imports are coal, petrol, lubricating oil, timber, and foodstuffs.

Detailed Description. Angra bay is a natural, open roadstead, about 1 mile in width and half a mile across (Photo. 113). The north-western part of this bay is a cove about 800 yards long by 600 yards wide which

forms the inner harbour. The shore of the harbour is rocky with few landing-places, the waterfront of the town being about 800 yards long and without quays or berths for vessels.

The approach to the bay is easy and clear. Large vessels anchor in 30 fathoms near the entrance; smaller vessels (up to about 12,000 tons) anchor inside the bay in depths of 7 to 13 fathoms. Three or four ships could anchor at the same time in the bay and six large ships outside it. The bay is open to southerly and easterly winds, and with the former a heavy swell sets round Monte Brazil. Fine weather prevails from June to September, but bad weather is common during the other months of the year. Spring tides rise about 6 feet.

The harbour has few facilities for landing, there being no mooring-buoys and no quays at which ships can berth alongside. The method of discharge is by lighters to jetties. There are three jetties. One is at the customs house in the middle of the town's waterfront; it is of cement, is 40 yards long by 18 yards wide, narrowing to 2 yards, has several sets of steps, and is lit by electricity. Another is in the western corner of the bay near the Castello de S. João Baptista; it is a cement jetty 28 yards long and 9 yards wide. The third jetty is near the Castello de S. Sebastião at the north-eastern corner of the bay; it is 65 yards long and 22 yards wide and has several sets of steps.

The harbour craft available include a few lighters (up to 35 tons) and several motor-boats and pulling-boats. There are no port facilities, the only repairs being for very small vessels, which are careened on the beach.

Communications. A good motorable road runs from Angra do Heroísmo around the whole of the island (46 miles), serving all the chief towns and villages. Other roads run north-westwards to Altares near the north coast (11 miles) and north-eastwards to Vila Nova (12 miles) and Praia da Victoria (13 miles). There are a few taxis and buses, and 30 to 40 private cars in the town.

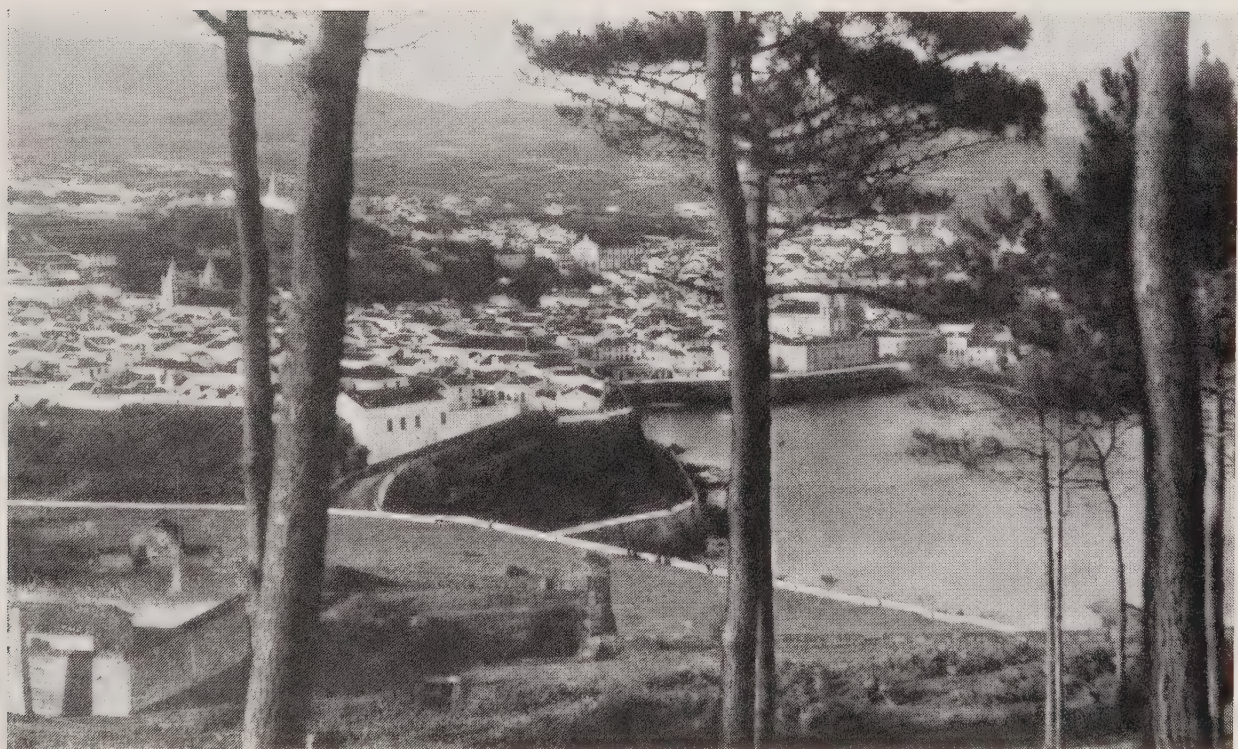
Lisbon steamers call twice a month, usually staying for a day, and small inter-island vessels visit the port when the weather permits. The signal communications include a submarine cable (via Pico) to Horta, a radio station for public service, and a telephone system which extends to the other towns and villages in the island (p. 350).

Communications

The island is encircled by a good motorable road which follows the coastline at distances ranging to a mile or more inland. There are two other good roads, both of which cross the island (Fig. 49). One



113. *Angra do Heroísmo from the sea*



114. *Angra do Heroísmo from Monte Brazil*



115. *Angra do Heroismo and Monte Brazil*

of them links Angra with Altares on the north coast, while the other joins Angra with Praia da Victoria on the east. All the roads are narrow, with no more than sufficient room for two cars to pass, and there is very little traffic on them. The minor roads are very narrow and winding and are in bad condition.

The main road round the island goes through most of the towns and villages of Terceira. Leaving the western side of Angra the road passes through S. Bartholomeu (4 miles) and then crosses the numerous ravines made by the torrents which descend from the Caldeira de S. Barbara. There are narrow defiles at the village of S. Barbara (8 miles) and at Doze Ribeiras (10 miles), and the road is of cornice construction at Raminho (17 miles). The road then follows the north coast and is joined at Altares (19 miles) by the main road across the island from Angra. At Biscoutos (21 miles) the road crosses a wide lava-stream, and there is another cornice section at Quatro Ribeiras. The road then enters the thickly populated north-eastern lowland and passes through Vila Nova and Lagens (28 miles), and so reaches Praia de Victoria (31 miles). South of this town the road is close to the bay for over a mile and then branches. The inland route reaches S. Sebastião (37 miles) by way of Ribeira Secca, which lies in a small ravine, while the coastal road has a cornice section and enters S. Sebastião from the east. The road then continues west well above the coast, passing through Feteira and finally reaches Angra (46 miles).

The plateau east of the Caldeira de S. Barbara is used by a good motorable road which crosses the island from Angra to Altares. This road runs north out of Angra for $1\frac{1}{4}$ miles, then turns sharply to the left, and after half a mile takes another acute turn to the right. The course of the road is then almost straight north-north-west and only bends to pass between two small volcanic craters (6 miles). About 7 miles from Angra a branch road to the right runs to Biscoutos, $4\frac{1}{2}$ miles from the fork. The road then crosses four streams in the last $2\frac{1}{2}$ miles of its course and reaches Altares (11 miles), where it joins the main road round the island.

Another good motorable road across the island joins the two ports of Angra and Praia. On leaving Angra the road climbs to over 1,000 feet and then follows a straight north-easterly course across a plateau, crossing an old lava-stream. At over 6 miles from Angra, and still on the flat open moorland, a branch road forks left to Vila Nova, while a poor road branches right to Ribeira Secca and S. Sebastião. About a mile farther on, the road leaves the plateau and crosses the northern

end of the Serra do Cume da Praia. The road then crosses a series of spurs and ravines and has a number of bends, including one sharp turn about 1 mile south-west of Praia. The road then passes through a built-up area and enters the main part of Praia from the west (13 miles).



116. *Caldeira of Graciosa from the south-east*



117. *Caldeira of Graciosa*



118. *Caldeira of Graciosa, Azores*

GRACIOSA

GRACIOSA, 'the gracious island', is 20 nautical miles to the north of S. Jorge and is thus the northernmost of the central group of the Azores (*frontispiece*). The island is 8 miles long by $4\frac{1}{2}$ miles wide and has an area of 23 square miles (Fig. 51). It is, therefore, smaller than any of the Azores, except Corvo.

Physical Geography

Graciosa is one of the least mountainous islands in the Azores, its most remarkable feature being the Caldeira (1,349 ft.) in the south-east. This is a crater with a lake and several eruptive cones. On the crater floor is the Furna do Enxofre ('sulphur bowl'), a cavern 500 feet long, 300 feet wide, and 70 feet high. Inside the cave is a small lake and several fumaroles (Photo. 117). Two high peaks are Pedro Botelho in the west and the Serro do Facho (1,227 ft.) in the centre of the island. In the neighbourhood of Victoria in the north-west there is considerable level land, which is regarded as an abrasion platform and as evidence of recent uplift (Photo. 119). The island is one of the least wooded of the Azores.

The coast is mainly composed of cliffs. There are few indentations and many rocks close inshore. The southern and western coasts, about 11 miles long, between the headlands of Carapacho and Pico Negro, are backed by several hills, the most prominent being the Caldeira in the south (Photos. 116-118). There are two small coves where landing is possible. The southern is between the rocky headlands of Branca and Fogo, near the island of Forte, while the northern is in Gomez bay.

The cliffs are broken and discontinuous along the $8\frac{1}{2}$ miles of the northern and eastern coasts. The best landing-place is at Santa Cruz in the north-east, but landing is also possible at the head of the bay opposite the islet of Praya.

Human Geography

This small island had 8,350 inhabitants in 1930, and thus had a comparatively high density of population. More than a quarter of the people (2,237) live in S. Cruz da Graciosa, the capital and chief port of the island. This town is at the head of a bight close west of Ferreira point (Photo. 120). There is only an open anchorage, but landing can be effected. S. Cruz has a radio station.

Another coastal town is Praya (1,432), 3 miles south-east of S. Cruz. There is a small sandy beach in front of this town, which has a

wooded background. From Praya it is 1½ hours' walk to the Caldeira. The most important inland settlement is Guadalupe, which with its district has a population of 2,647 persons. Some houses in Graciosa have large pyramidal chimneys.

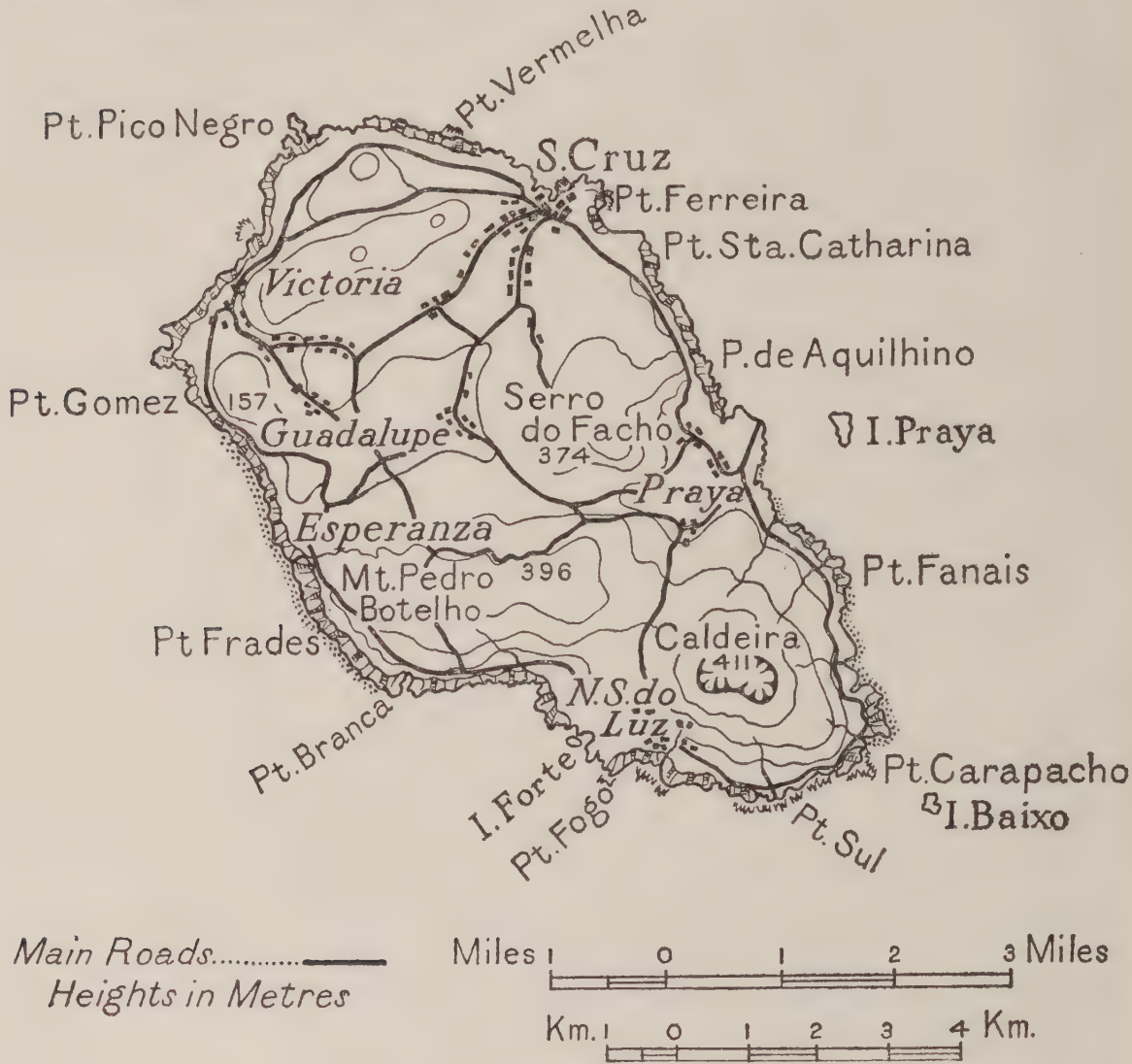
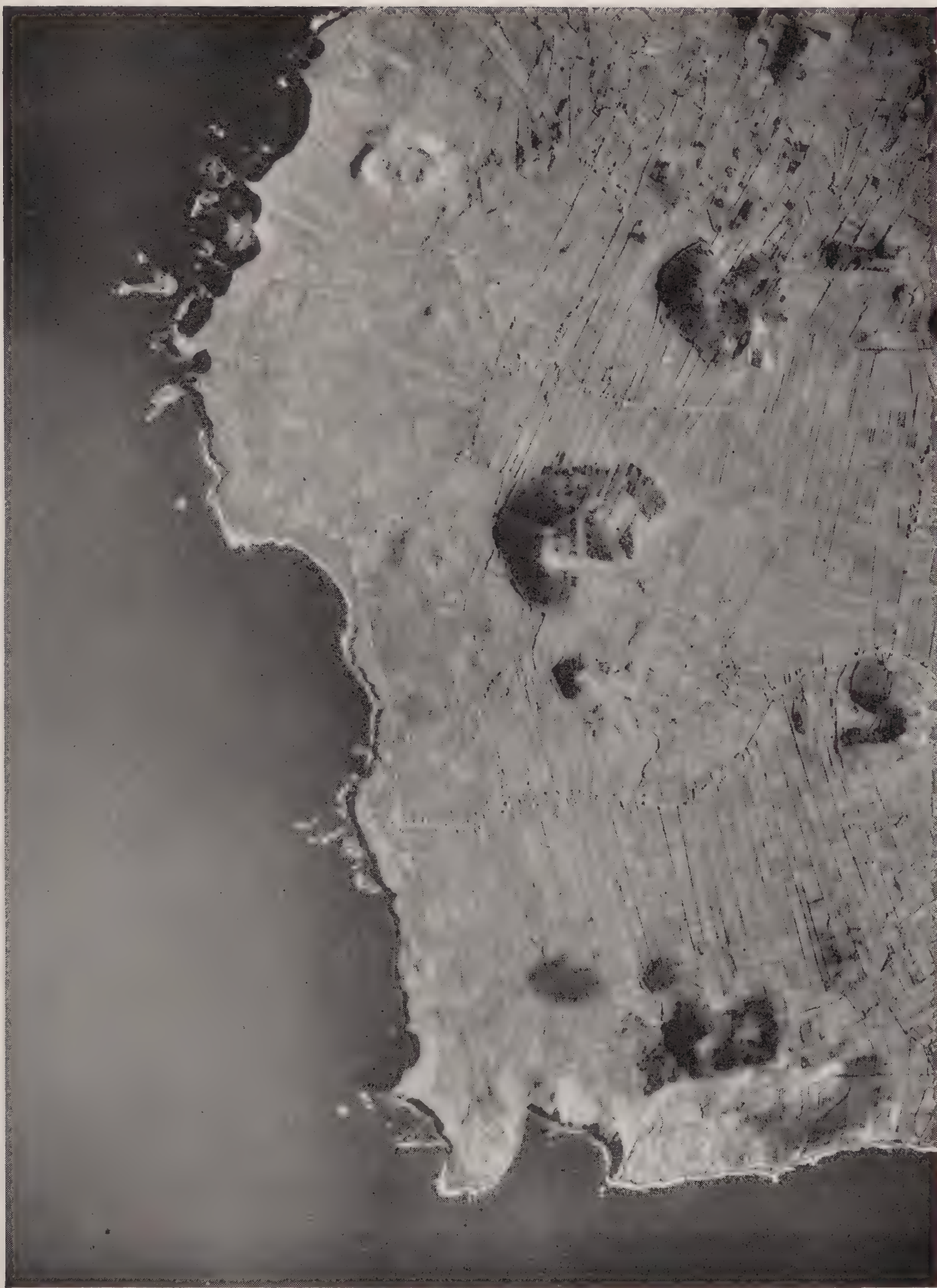


FIG. 51. Graciosa (Azores)
Relief shown by form lines

The island is fertile, and wheat, barley, maize, fruit, and vegetables are grown. Seaweed is collected for use as a fertilizer. Sheep, pigs, and poultry are all raised, and the island is known for its breed of very small cattle.

S. Cruz is the hub of the communications of Graciosa. There is a coastal road which follows the whole circumference of the island and crosses deep valleys with many bridges. One road crosses the island from S. Cruz to Guadalupe and so to the west coast. From Praya another road crosses the island in a southerly direction to Nossa Senhora do Luz.



119. *North-western part of Graciosa, showing Victoria*



120. *North-eastern part of Graciosa, showing Santa Cruz*



FIG. 52. *S. Jorge*
Relief shown by form lines

S. JORGE

S. JORGE lies south of Graciosa and is separated from Pico by a channel 11 nautical miles in width; it is also half-way between Fayal and Terceira. The island is long and narrow and its general direction is from south-east to north-west. S. Jorge is 33 miles in length and has a maximum breadth of 4 miles, but it tapers at its north-western extremity, and its shape has been aptly compared to the blade of a sword (Fig. 52). The area of the island is about 92 square miles.

Physical Geography

The island is formed of a chain of mountains which is divided into two parts by a valley which extends in a roughly north-to-south direction behind Calheta. To the south of this valley the highest peaks are Cabeza de Patalogos (3,123 ft.) and Cabeza de Fojos (2,825 ft.), while to the north of the valley lies the highest part of the island. A considerable area in the mountains north of the valley reaches or exceeds a height of 3,000 feet, and the steep northern sides are deeply dissected by a succession of streams (Photo. 123). The highest peak in S. Jorge is Pico da Esperanza (3,498 ft.), almost in the centre of the island; its last eruption was in 1808. As the island becomes narrower towards the north-west, the general level also becomes lower.

It is worth noticing that, apart from Pico, the highest points in the three largest islands are roughly the same altitude, namely 3,626 feet in S. Miguel, 3,356 feet in Terceira, and 3,498 feet in S. Jorge.

The island is said to be well wooded and well watered, but little is known about its vegetation and water-supply. The finest specimens of the Azorean juniper grow on the uplands of S. Jorge, and they may attain a height of 18–20 feet in this island.

S. Jorge is bordered by rugged and precipitous cliffs. There are no good harbours, but several coves on the south side provide shelter for small craft. The northern coast from Ponta de Rosales to Ponta do Tôpo, about 26 miles long, is particularly steep. The cliffs are everywhere at least 1,000 feet in height and exceed 1,600 feet about half-way along the coast. There are no landing-places, as the cliffs are abrupt and steep, and there are off-lying rocks in the north-west.

The southern coast has lower cliffs, but they are seldom below 300 feet. There are two landing-places on this coast, the most important being that of Vellas. An inferior landing-place lies at the mouth of a small creek to the east of Calheta. Other small beaches lie in the shelter of the islet of Tôpo and south-east of Ponta dos Castellitos.

Human Geography

The population of the island in 1930 was 13,772. Of this figure 2,058 were concentrated in Vellas and 1,448 in Calheta, the capitals of the two *concelhos* into which S. Jorge is divided (Fig. 52). The rest of the population is scattered in small coastal villages on the southern side of the mountains from Ruiva in the north to the area south of Cabeza de Patalogos in the south. This long ribbon of settlement is separated from the inhabited area in the extreme south of the island by an uninhabited zone. The principal village in the south is Tôpo.

The north side of the island is almost devoid of habitation, but there are a few scattered settlements about 1 mile inland between Ponta Furada and Ponta Fajão do Bello.

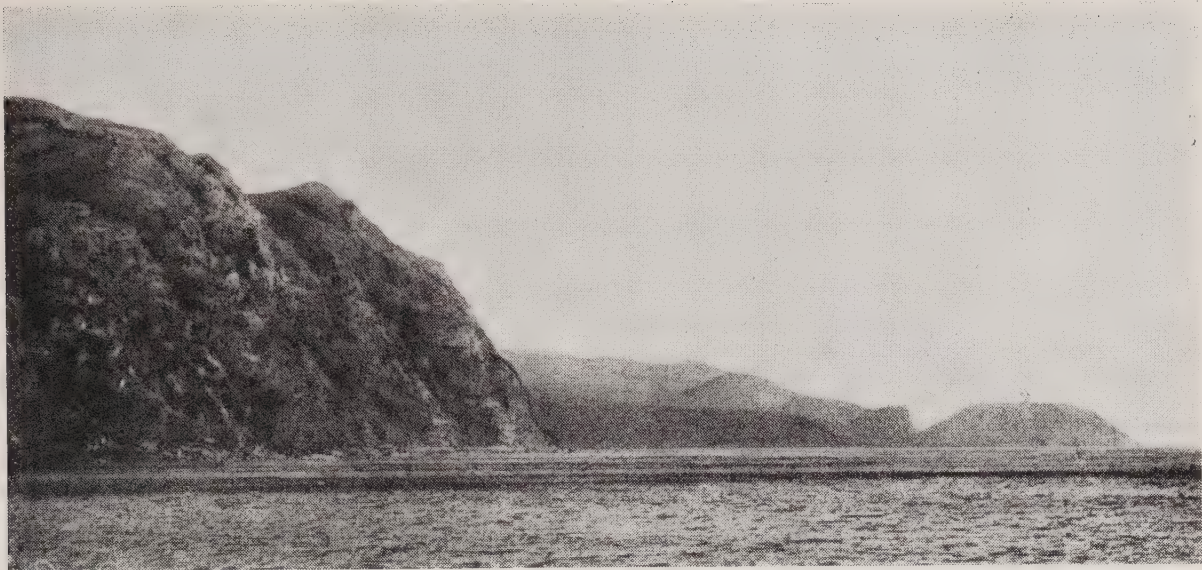
The island is fertile and well cultivated, wheat, maize, and beans being produced; the vine is also cultivated. In van Linschoten's time (about 1589) the inhabitants chiefly raised cattle and conveyed their produce to the other islands. This is still the case at the present time, as there is much good pasturage and excellent butter and cheese are produced. The cheese is a kind of Gruyère and has a considerable reputation. Beans, dairy produce, some store cattle, and some timber are exported to the other islands.

There is a fishing industry, and at Tôpo gaily coloured rugs are made.

Vellas is the only anchorage which affords any shelter on the south side of the island. The headland of Morro Grande, which is formed of a volcanic crater, gives a certain amount of protection to the anchorage at Vellas (Photos. 121, 122, and 124). There is a mole situated in a cove south-east of the town. A radio station is established at Vellas, and a steamer from Lisbon calls here once a month.

At Calheta there is a small landing-place in front of the village at the mouth of a stream with numerous rocks close off shore. Wood is exported from Calheta, and the Lisbon steamer calls here once a month when it does not call at Vellas. The island thus has two visits per month from steamers from Lisbon.

The roads in the island are said to be poor. A coastal road runs along the whole of the south coast connecting Ruiva with Vellas, Calheta, and Tôpo. On the north coast roads only exist for about half its extent. From Calheta a road follows a valley across the island and then turns north to run parallel with the north coast to the northern end of the island, where it has a connexion with Ruiva by means of a short road across the island.



121. *South coast of S. Jorge near Morro Grande*



122. *Vellas, S. Jorge*



123. *North coast of S. Jorge with Ponta Norte Grande and Pico da Esperanza*



FIG. 53. *Pico*
Relief shown by form lines

PICO

THE island of Pico derives its name from the volcanic mountain of O Pico situated in its western part. Pico is separated from S. Jorge by a channel 11 nautical miles in width and from Fayal by a channel 3 to 4 miles across. The island is irregular in shape, wide and rounded in the west and narrow in the east (Fig. 53). Pico is 28 miles long and 10 miles across in its widest part and has a total area of 167 square miles; it is therefore the largest of the Azores after S. Miguel. Pico is a little shorter than the narrow island of S. Jorge, whose general direction is parallel with it. If the island of Fayal is included with Pico the length of the volcanic chain of the two islands combined is 44 miles, which is greater than the length of S. Miguel.

PHYSICAL GEOGRAPHY

Relief

The chief feature of Pico is its great volcanic cone of O Pico (7,615 ft.), by far the highest mountain in the Azores, none of the other islands attaining half its height. The characteristic appearance of O Pico is that of a mountain rising with easy slopes for its lower two-thirds, and then ascending precipitously to the summit (Photo. 125). Except on its southern side it rises gently up to between 2,000 and 2,500 feet, after which there is a steeper gradient to between 4,500 and 5,000 feet, and then it ascends rapidly to the top. It attains its maximum elevation of 7,615 feet at 2.42 geographical miles from the coast, which represents an average angle of slope of about 27° . Taking the shortest distance from the coast as $7\frac{1}{2}$ miles and the altitude as 12,180 feet, the Peak of Tenerife rises from the sea on its north side at an average angle of about 15° . There is every excuse for the traveller who carries away an exaggerated impression of O Pico as rising in places almost sheer from the sea.

Due south of the cone, the mountain in its lower half drops about 3,000 feet in a thousand yards. Here is a line of huge bluffs the precipitous faces of which are deeply scored by gorges and gullies forming dry river-beds, the largest of them being known as the Ribeira Grande. The steep sides of these valleys, carved into spurs and buttresses, are usually well wooded, except in the gullies and gorges, and they terminate abruptly in the low and narrow strip of coast on which lie two small villages. These bluffs constitute the most precipitous

portion of the lower slopes of the mountain and present one of its chief spectacular features. Above the higher edges of the bluffs the steep upper slopes of the mountain are streaked by 'slides' of boulders and loose blocks of lava. Quite frequently the huge boulders roll down the slide and ultimately plunge into a field or garden of the coastal villages. These rocks, often bounding 4,000–5,000 feet down the steep mountain side, may come crashing into the villages in the middle of the night.

The craters of the numerous small secondary cones on the slopes of O Pico vary usually from 50 to 250 feet in height, their interior as well as exterior being grassy or wooded. Many of them are situated at elevations of from 2,000 to 5,000 feet. In some cases the craters are inaccessible, but in other cases a narrow gap leads into the crater, which may have been used as a corral for cattle. The craters are usually dry, and only in the case of the smallest cones do they hold shallow ponds. Some of these cones are very regular in form, and one which lies at the foot of the cone proper on its north-west side, at about 4,000 feet, has a height of 200 feet and a crater remarkably symmetrical in shape, 500 feet across and as deep as the hill is high.

To the east of O Pico is a broad plateau which is raised not less than 2,000 feet above the sea. This plateau is dotted with small volcanic cones and is in part grassy and in part boggy, cattle grazing here in numbers. To the east of the plateau is a ridge with a general level of 2,500 to 2,800 feet, and from it rise abruptly several isolated peaks, the highest having an altitude of about 3,500 feet. This ridge continues as far as the eastern extremity of the island. Numerous mountain lakes lie interspersed among the peaks at 2,500 to 2,900 feet. They are shallow, and are usually 300 to 500 yards in length. A little to the south of the main ridge is Pico Tôpo, which has an altitude of 3,357 feet. On many maps this mountain is still credited with a height of 5,357 feet, a mistake which dates back to the survey of the archipelago by Captain Alexander Vidal, R.N., in H.M.S. *Styx* in 1842–1844. South of Pico Tôpo is a broad promontory which is crowned by some craters known as the Cabeza da Granga.

Drainage and Water-supply

There are no permanent rivers and few surface streams on Pico, but as the frequent occurrence of the local name of 'Ribeira' indicates, there are numbers of torrent-beds and watercourses. These carry off the water after heavy rains, but are dry during most of the year. The deep gorge of the Ribeira Grande has been scooped out of



124. *Vellas and Morro Grande, S. Jorge. The north coast can also be seen*



125. *O Pico*



126. *Lagens, Pico*

the side of O Pico, and its slopes rise up from the coast to a height of 3,000 feet within half a mile. It is probable that at the time of their discovery, when the islands of the Azores were densely wooded, the streams were more permanent in their character. At the present the only surface water is the standing water of the upland swamps and of the mountain lakes. There are no thermal springs on this island, nor are there any permanent streams partially fed by hot springs.

There are no springs on the great mountain and apparently but few in the eastern part of the island. Yet fresh water oozes into the sea all around the coasts. Peasants in the coastal villages, who are too poor to build a covered rain-tank of masonry, obtain their water-supply from wells sunk in the rubble of large and small blocks of lava immediately behind the beach. Probably most of the water issues at the coast between the tide-marks, and it is here that women living far from a well often wash their linen.

The water in the coast wells of Pico is always a little brackish. As with those of S. Mateus, Magdalena, Caes do Pico, Prainha, and other places at the sea-border, the wells have sometimes to be sunk to a depth of 15 to 20 feet, the level of the water being that of the sea. But their water is in summer much cooler than the sea. Permanent springs are only to be found off the great mountain, and they are few in number. However, the coast village of S. Amaro is supplied with water by a spring which issues on the mountain slopes about 2,000 feet above the sea, its temperature on an August afternoon being 54° F., or about 10 degrees cooler than the mean temperature of the air in the shade at that altitude.

A similar spring is said to exist far up the mountain-side behind Caes do Pico, but it is not utilized by the villagers. At the head of a gully, some 500 or 600 feet above this place, there is a water-source which has been protected by masonry, but it seems to be only used for washing clothes. Here the water is derived from the drippings of cliff-faces on either side, the line of underground seepage being cut across by the gully, which shows that in the eastern part of the island there is a large amount of fresh water available. Lack of funds is the great obstacle, though a little enterprise, like that shown by the natives of S. Amaro, might provide several other of the coastal villages with good water from the mountains. Dripping-cliffs in particular ought to be fairly common, and, since they afford a substitute for permanent springs, they might readily be utilized for this purpose.

Vegetation

The lower slopes of the mountain of Pico are generally well covered with vegetation up to 4,500 or 5,000 feet, moor and grassland predominating between 2,000 and 4,000 feet. But woods are well developed in places, the lower woods on the western side and the upper woods on the south-eastern side. They are essentially formed of ever-green shrubs and trees; but on account of the persistent work of wood-cutters through the centuries the trees rarely exceed 20 feet in height, and are usually not more than 15 or 16 feet. Dwarfing begins, as a rule, at about 4,000 feet, as the effect of deficient soil and exposure to strong winds. Above 5,000 feet are the sparsely covered, precipitous lava slopes of the cone proper; but in spite of the conditions five or six kinds of plants, usually as stunted and creeping growth, reach the summit.

The following five zones of vegetation may be recognized on the mountain:

I. *The Lower Woods or the Faya Zone.* This area extends from the coast up to 2,000 feet, *Myrica faya* being one of the most characteristic of the trees. Besides the Faya, other trees peculiar to the zone are *Rhamnus latifolius*, *Persea (Laurus) indica*, and *Picconia excelsa*. Trees which are abundant in both the Upper Woods and Lower Woods Zones are *Ilex perado*, *Erica azorica*, and *Laurus canariensis*.

II. *The Upper Woods or the Juniper Zone.* This extends between 2,000 and 4,500 feet for the woods proper and from 4,500 to 5,500 feet for the scrub. There is often a transitional area between 2,000 and 3,000 feet, where the plants of the Faya and Juniper Zones intermingle, but as a rule the Juniper begins where the Faya ends. The three most distinctive trees and shrubs of this zone in their order of frequency are *Juniperus oxycedrus*, *Daphne laureola*, and *Euphorbia stygiana*, the tree-euphorbia.

III. *The Cone Proper.* This is the highest zone of the mountain, between 5,500 and 7,600 feet. All the plants growing on these scantily covered steep lava slopes have climbed up from the lower levels, principally from the moors described below. The common impression that the lower two-thirds of the mountain are covered with vegetation, and that the slopes of the upper third are barren, is erroneous.

IV. *The Zone of the Upland Moors.* This area is between 2,000 and 4,000 feet and has been formed at the expense of the Upper Woods around much of the mountain, although they are crossed at intervals by broad strips of woodland. This zone is said to resemble a Devon-

shire moor in several respects. The most striking general features are the bracken, the large tussocks, and the beds of *Sphagnum*. Though doubtless greatly extended by the destruction of the forests since the discovery of the islands, the moors have probably always formed a conspicuous feature of the mountain of Pico around the base of the central cone. These lands are usually used as pasture-land for cattle, the lower parts being under private ownership, while the upper parts, marked off by a high wall, usually about 3,000 feet above the sea, are known as the Baldios do Conselho or common-lands (Fig. 53).

The cloud-belt or rainy zone, 2,000 to 5,000 feet, corresponds to the Juniper Zone and to the belt of the Upland moors. While the rainfall is much less on the high levels than on the cloud-invested Juniper Zone and Upland moors below, this deficiency is partly compensated for by heavy dews. The mere concealment of the peak by clouds, when seen from the coast, does not imply that the summit is cloud-capped. The upper third of the mountain is often exposed in a clear sky to the full glare of the sun and rises out of a billowy sea of clouds of dazzling whiteness, like an island in the midst of arctic snows (Photo. 2).

The lower limit of the snow cover is generally about 4,000 feet, and it should be noted that on the summits of the other islands in the Azores, that reach a height of about 3,500 feet, snow rarely lies. It is never very deep on Pico and finally disappears in May.

In the east of the island the peaks are mostly bare of trees and shrubs, and their steep slopes provide grazing for sheep. In the areas between the mountains, where lie the lakes, there are extensive wet moors. There are also large areas covered with wood and brush. Juniper is very common and attains a much larger size than on the slopes of Pico, their height being often 15 feet and their diameter 15-20 inches.

Coasts

The coasts are comparatively free from indentations, and though they are steep and rugged, there are several coastal villages at which landing is possible in fine weather.

The northern side of Pico from Ponta do Baixio Grande to Ponta da Ilha, a distance of 29 miles, has five landing-places. The best of these is Caes do Pico, a small bay; there are two small coves near by, one $1\frac{1}{4}$ miles to the east, in front of the village of S. Roque, where a small stream enters the sea; the other a mile to the north-west near the village of S. Antonio. Behind these three villages the slopes are

terraced with vineyards. The landing-place in the north-west is at Porto do Caxorro, a small bight, which is difficult of access. On the low-shelving promontory in the east landing is possible at Porto do Baixio, a bay in the shelter of Lagido point. Except for these bays, the north coast has abrupt cliffs, formed in places of lava flows.

The more sheltered southern coast from Ponta da Ilha to Ponta do Espartal is bordered by fairly steep volcanic cliffs. The main harbour lies midway along the coast at Lagens; here a small lagoon with a rocky entrance is connected to the sea at high water. The town is built at the head of the lagoon, and extends along the coastal road. Pico Tôpo, 2 miles to the north, cuts off direct communication with the north coast. The other landing-places are used mainly by local craft. In the east there are two small coves between Ponta da Ilha and Calheta do Nesquim, and one facing the fishing-village of Ribeiras. West of Lagens, the most accessible coves are in front of the village of S. João, and on the eastern side of Ponta de S. Mateus.

The 8 miles of the west coast between Ponta do Espartal and Ponta do Baixio Grande face across the Fayal channel to the port of Horta on Fayal. The coast is bordered by off-lying rocks, but landing is possible in a small creek, above which stands the town of Magdalena.

HUMAN GEOGRAPHY

Distribution of Population

In 1930 Pico had a population of 20,112 persons. The density of persons per square mile is lower than in any other of the islands except Corvo. The whole of the interior of Pico, both east and west, is uninhabited, settlement being confined to a narrow coastal belt (Fig. 53).

Lagens (2,467), the largest town in Pico, was founded in the year 1500 and is on the south coast south of Pico Tôpo. On the west coast Magdalena (1,887) lies opposite Horta in Fayal, while on the north S. Roque (1,417) is the principal town. These three towns are the capitals of the three *concelhos* into which Pico is divided, and between them they contain nearly 6,000 of its 20,000 inhabitants. The rest of the population is distributed in the succession of villages all lying just above the cliffs the whole way round the island.

Industries

The principal industry is agriculture. The vine is cultivated on O Pico, especially on the slopes which face Fayal. Before 1853 Pico

was the principal vineyard of the Azores, and as many as 20,000–30,000 pipes of a dry rather high-flavoured wine which commanded a fair price under the name of 'Pico Madeira' were exported annually. The principal market was the British West Indies, where the wine had a good reputation. These colonies had an agent in Fayal who contracted for the principal part of each vintage from Pico. After having suffered disastrously from disease, these vineyards are now being re-developed. Although wine is no longer exported, the vine is still grown, the plant being trained on long low piles of basalt. The whole ground is chequered by these heaps into little squares. The grape now grown is small and called Isabella. Tobacco is cultivated in terraces on the lower parts of the mountain and figs and apricots are also grown.

The ground available for cultivation is limited, and the natives of Pico have to import a considerable proportion of their food from the neighbouring islands.

Pico has been for generations the principal source of fuel for the neighbouring island of Fayal. At present a regular trade in Pico firewood exists between the towns and valleys on the Pico side of the strait and Horta in Fayal.

Firewood is the eternal question with the inhabitants of the Azores, but only the stoutest pieces are used for cooking their food. Nothing is wasted, the foliage serving as fodder, the leafy branches as litter in their stables, and the branches of the ling (*Calluna vulgaris*) and the tree-heath (*Erica azorica*) as brushwood. The procuring of these materials seems to be one of the principal occupations of their lives. On the lower slopes of the great mountain of Pico, all through the year, a constant string of men and women and bullock-drawn carts carry loads of *Erica azorica*, *Calluna vulgaris*, *Myrica faya*, *Laurus canariensis*, and *Ilex perado*, the foliage of the last-named plant being cut in quantity for mule fodder. There is no attempt to renew the sources of supply. The land is allowed to remain undisturbed for several years, and the owner makes considerable profit by selling it with the wood standing, receiving it back when the wood is all felled. Faya trees attain a diameter of 5 or 6 inches in from 8 to 10 years, so that the growth of one of the most abundant and most useful of the trees is not a very rapid process.

The lower wooded slopes of the mountain of Pico below the government lands, 3,000 to 4,000 feet above the sea, are all private property. Low walls of loose lava blocks separate the different properties, the poor man having a small patch and the rich man a large one. These

properties are handed down from parents to children and the rights are rigidly observed; they may remain in the same family for generations. A bequest of a small patch of woodland for some poor widow is as much a necessity of her existence as a dwelling, and willing hands help her to bring the faggots down the mountain side if she is old and feeble. A large amount of the carrying is done by women, whilst the men do the felling. The poorer people of the larger coast towns, like Magdalena, usually purchase their wood off the land from the owner, fell it themselves, and carry it home.

Ports and Communications

There are no sheltered harbours on Pico, nor are there any good anchorages for large vessels. The port of Lagens consists of a lagoon with an outlet to the sea at high water and is accessible only to boats and small fishing-vessels (Photo. 126). A steamer calls here monthly on its round trip from Lisbon to the Azores.

Magdalena on the west coast has a small landing-place on a narrow point jutting into Magdalena bay. There is a daily launch service between Magdalena and Horta on Fayal, but this service is often interrupted in winter by heavy seas. Much of the produce of Pico is exported from Magdalena to Horta in small boats. There is a radio station at Magdalena (p. 350).

Caes do Pico, on the north coast, has a small landing-place for boats. A steamer, which does not call at Lagens, calls here monthly on a round trip from Lisbon to the Azores.

The three small ports of Lagens, Caes do Pico, and Magdalena are connected by telegraph. They are also connected by a coastal road which encircles the whole island. In the west and north-west this coastal road is duplicated. It is noticeable that no roads cross the island's mountainous backbone.

The ascent of Pico usually takes two days from Magdalena, the night being spent at Serra Gorda.



FIG. 54. Fayal

The contours in the north-west are only approximate

FAYAL

FAYAL or Faial derives its name ('isle of beeches') from a shrub called *Myrica faya* which resembles the beech and is very common in the island. The distance from north to south is about 9 miles, while at its widest the island is 13 miles across. The total area of the island has been computed at 65 square miles. Fayal is the westernmost of the central group of the Azores and is separated from Pico by the Fayal channel, about 3-4 miles in width.

The island's importance is derived from factors which are all associated with its principal town, Horta. This place is the best port in the Azores except Ponta Delgada, as well as being the greatest cable station in the world, while its meteorological station is of vital significance in the north Atlantic.

PHYSICAL GEOGRAPHY

Relief and Water-supply

The principal physical feature of Fayal is the Pico Gorda (3,350 ft.), which rises roughly in the centre of the island (Fig. 54). This symmetrical volcanic mountain was last active in 1672 and has a crater which is more than 1 mile in diameter (Photo. 129). The floor of the interior of the crater is about 1,300 feet below the rim and contains a large lake.

To the east of the great crater the slopes towards the sea are gentler than those to the north and to the south. All the streams which flow down the north and south sides of the crater are short and have steep gradients, but the steepest slopes are those which face the south-west and these are scored by numerous gullies. From the crater several parallel ridges extend in a south-easterly direction towards the Fayal channel. One ridge ends a short distance from the sea south of Ribeirinha, while another runs from Arrochela, south-east of the crater, and reaches the sea at Ponta Espalamaca. Between these ridges the longest streams in the island find their way to the sea. To the west of Horta there are a series of craters including Carneiro (876 ft.) which is nearly 2 miles due west of the town (Photo. 127).

West of the great crater a broad promontory juts out from the main mass of the island and is crowned by the heights of Cabeço del Fonte (1,614 ft.) and Cabeço do Norte (1,135 ft.). A series of craters, including Pico do Fogo, lies to the west and north-west of Pico Gorda (Photo. 128).

Water is present in abundance on Fayal both in wells and in mountain streams. Nevertheless, the supply of water at Horta is deficient, especially in summer. This is largely a matter of distribution as the town's reservoir is antiquated and insufficient in capacity. The Telegraph Cable Company sink their own wells and find the water is brackish.

Vegetation

Like the other islands in the group Fayal was formerly covered with a rich mantle of woodland, most of which has been cut down. Patches of woodland exist notably in the neighbourhood of Flamengos, where fine eucalyptus trees, oaks, and chestnuts are found. Much of the island is rocky and hilly and from a distance appears to consist of innumerable small fields divided by stone walls. The precipitous slopes of the great caldeira are covered with heath and faya trees. The large lake at the bottom of the crater is surrounded by rushes, mint, tansy, and grass on which sheep are grazed.

The island is famed for its wealth of hortensias (*Hydrangea hortensia*), dense bushes of which line the streets or paths, and which are often, but wrongly, said to have derived their name from Horta (Photos. 130 and 131).

Coasts

Fayal is a compact island, except for the rounded projection which extends on the west side of the island towards Ponta Comprida and Ponta Negra. In the south-east the Baia de Horta provides an excellent harbour. The south coast of the island is generally low but is fringed with rocks, while the northern coast has precipitous cliffs.

Lying in a sheltered position facing Pico across the Fayal channel, the semicircular Baia de Horta extends for 3 miles between Ponta Espalamaca and the peninsula of Monte Guia. From Ponta Espalamaca, which is 420 feet high, cliffs descend abruptly to the sea as far as the mouth of the stream at Conceição. Thence a sandy beach lies in front of Horta. The Monte Queimada rises above the southern end of the beach to a height of 256 feet, and at its base a mole has been built parallel with the shore. A low isthmus called Entre Montes extends between Monte Queimada and Monte Guia, a steep-sided peninsula which is the remnant of a volcanic crater. On the southern side of Monte Guia an opening known as the Caldeira Inferno provides a safe shelter for small craft. On the north-west of Monte Guia is the Baia de Pim, which is used in fine weather by local vessels.



127. *South-eastern slopes of Pico Gorda with island of Pico in background*



128. *Pico do Fogo in western Fayal*



129. *Caldeira of Fayal*

The southern coast, about 7 miles long from Porto Pim to Ponta de Castelo Branco, is edged by low cliffs with many off-lying rocks. There is a landing-place, with a small slipway, at Ponta de Forte about 2 miles east of Ponta de Castelo Branco, a conspicuous peninsula, tied by a narrow isthmus to the island.

The south-western coast from Ponta de Castelo Branco to the headland of Ponta Negra is edged with steep cliffs to Ponta do Varadouro (Photo. 132). Landing is difficult, though a shelving boulder beach east of Varadouro could be used by small boats. A steep track $1\frac{1}{2}$ miles long leads to the main coast road. There is a similar cove north of Ponta Comprida, about $2\frac{1}{2}$ miles from the coast road.

The north coast, nearly 15 miles long between Ponta Negra and Ponta da Ribeirinha, is edged by high cliffs which are scored by numerous small torrents. There is no good landing-place on this coast, but there is one beach at the Baia da Praia do Norte (Photo. 133) hemmed in by abrupt cliffs, while others exist to the east of Ponta do Salão, where there is a small boulder-strewn bight, and on the southern side of Ponta da Ribeirinha, which has a pebble beach with a concrete jetty suitable only for rowing-boats, and joined by a track to the village of Ribeirinha.

On the east coast from Ponta da Ribeirinha to the bay of Horta the cliffs are fairly steep, the land above them being cultivated. The Baia de Praia has a short mole, but the beach is strewn with boulders.

HUMAN GEOGRAPHY

Distribution of Population

The population of the island in 1930 was 21,432, with a density of about 330 persons per square mile. The villages and towns are all on or near the coast, and there is a discontinuous ribbon of settlement round the rim of the island (Fig. 54).

More than one-third of the population is resident in Horta (7,643), which is fully described on pp. 329-332. The most densely populated part of Fayal is the south-east, each of the valleys between the ridges being well peopled. In the valley west of Horta are the villages of S. Amaro and Flamengos (Photos. 134 and 135). North of Horta the village of Praia do Almoxarife (900) lies just inland from the Baia de Praia. On the south coast Feteiras (1,974) and Castelo Branco are the most important villages, while on the north coast Cedros (2,803) is the largest place after Horta.

The central part of the island is uninhabited and the north-west is thinly peopled, even on the coast, but Praia do Norte has 551 inhabitants.

Industries

Agriculture is the principal industry. The island is fertile, and maize, wheat, beans, melons, potatoes, and yams are all grown (Photo. 137). The rainfall in Fayal is much greater than in Pico. In Fayal tea is planted, but the vine does not flourish. In Pico wine is made, but tea-gardens are unknown. Some vines are grown in Fayal, but the so-called Fayal wine is in reality the produce of Pico. In the cultivated areas there are many low stone walls which are used to divide the fields.

The main source of wealth of the islanders is the pastoral industry, as the land provides excellent pasturage for both sheep and cattle. The annual export of cheese to Lisbon is 176,000 lb. and of butter 132,000 lb. The number of livestock in the island in 1935 is given in the following table:

Horses	341
Mules	124
Donkeys	1,164
Cattle	26,209
Sheep	16,303
Poultry	70,300
Pigs	8,832

Fishing is carried on from Fayal, and the Fayal channel provides good catches, as does also a bank 50 miles south-west of the island. Mackerel, tunny, and bonito are important items in the catch. There are two fish canneries on the island. The whaling industry was formerly considerable but is now insignificant.

Some small household industries survive. A fine lace is made by the women from threads of the agave plant. There is also some fine basket-making and carving in snow-white pith of fig-wood. Large straw hats, wicker work, feather flowers, and drawn linen (*crivo*) are all produced on a small scale.

Ports

The landing facilities at Fayal are very limited, the chief apart from Horta being a small slipway at Ponta de Forte on the south of the island, and a concrete jetty for boats on the south side of Ponta da Ribeirinha.



130. *Road bordered by hydrangeas, Fayal*



131. *Road near Ribeirinha, Fayal*



132. *Ponta do Castelo Branco, Fayal*



133. *Bay of Praia do Norte, Fayal*



134. *Flamengos from the east*



135. *Flamengos from the west, with island of Pico in background*



136. *Porto Pim with Monte da Guia in background*



137. *Windmills on Fayal with island of Pico in background*

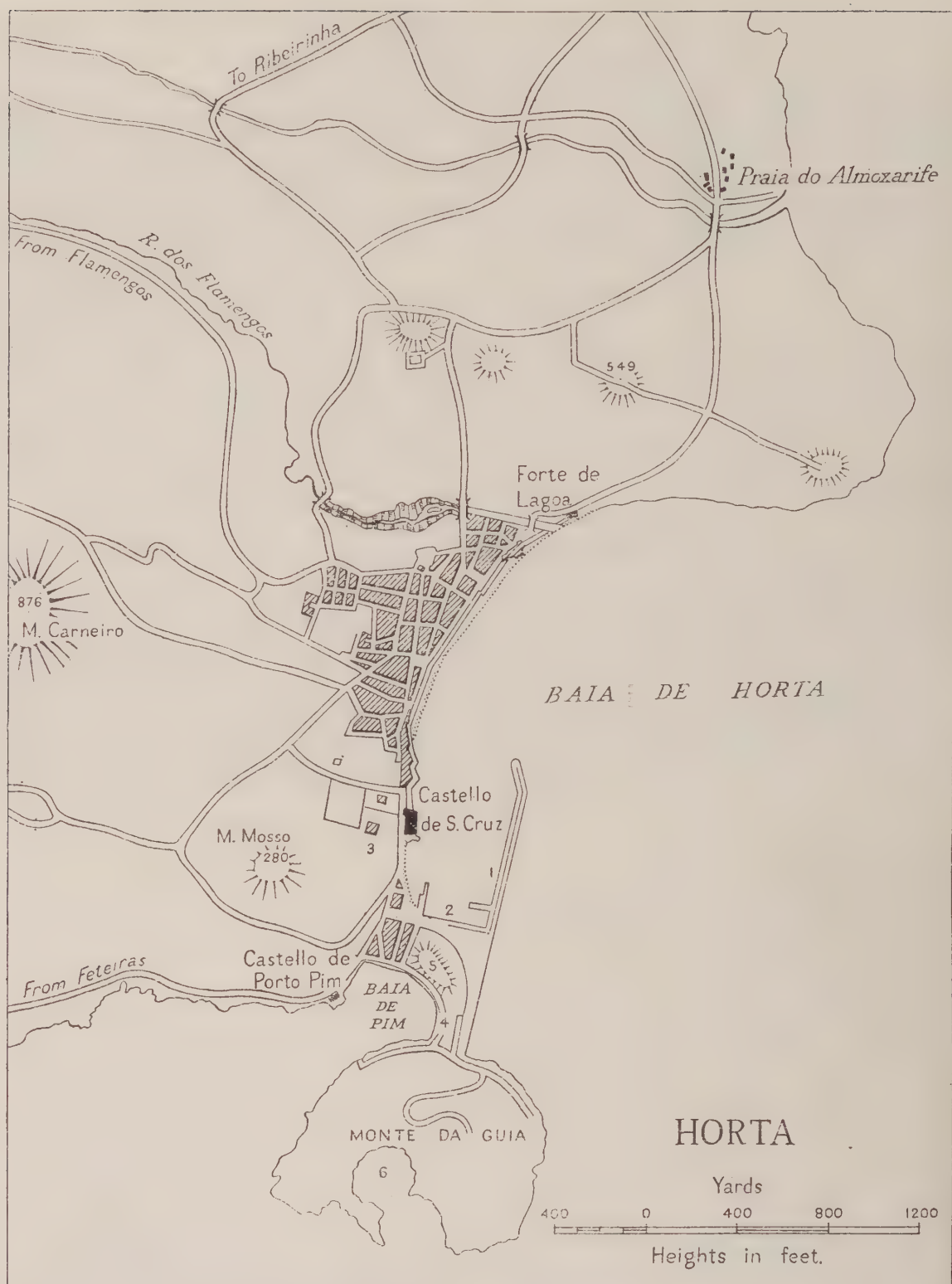
HORTA. (Lat. $38^{\circ} 32'$ N., long. $28^{\circ} 38'$ W. Population 7,643 in 1930.)

General Description. Horta lies at the south-eastern corner of Fayal near the fertile valley of Flamengos. The early settlement was built on a gently sloping plain at the foot of Monte Carneiro (Fig. 55). The shore here was sandy and derived some shelter from a cliffed headland on the north and the peninsula of Monte da Guia on the south. This peninsula is an extinct crater, of which the rim rises steeply to 433 feet and the floor has been submerged to form a small natural harbour. The flat narrow neck of the peninsula is broken by Monte Queimada, a steep-sided hillock crowned to-day with fortifications. Other similar volcanic hills occur near the town, the chief being Monte Carneiro (876 ft.) and Monte Mosso (280 ft.). North of the ravine of the Flamengos river a large highland spur divides the flat coast near Horta from the small lowland at Praia do Almoxarife (Photo. 138).

The main built-up area stretches for about 1,300 yards along the beach between Forte de Lagoa and Castello de S. Cruz and in no part extends more than 750 yards from the shore (Photos. 139 and 140). The town is solidly constructed, mainly of one- and two-story houses built of igneous stone, the walls being covered with plaster and white-washed. The buildings are roofed with half-cylindrical pottery tiles of a red colour. Most of the streets are narrow and ill lighted; the principal ones are paved with oblong blocks of stone and have narrow slightly raised sidewalks. Some of the streets are steep and rise to a height of about 300 feet within 500 or 600 yards of the beach. The immediate outskirts of the town consist mainly of luxuriant gardens and orchards.

Horta is the seat of an administrative district comprising the islands of Fayal, Flores, and Corvo. In size it is the third town of the Azores, but it ranks high in international importance owing to the fact that it is a great cable centre and a base for Pan-American Airways. Horta has no buildings of notable architectural interest; its significance lies in its modern buildings such as the cable offices, the meteorological observatory (on the eastern slopes of Monte Mosso), and the Pan-American Airways office (just west of the Castello de S. Cruz). There are a few hotels and two hospitals in the town.

History. Horta probably derives its name from its Flemish founder Jobst van Huerter, who established the first settlement on Fayal with Flemish colonists in the fifteenth century. Until the nineteenth century Horta was of far less importance than Angra or Ponta Delgada, but the invention of the telegraph cable and later of the aeroplane has greatly increased its significance. The first aeroplane to

FIG. 55. *Plan of Horta*

1. Mole and breakwater. 2. South quay. 3. Cable office. 4. Cable houses.
5. Monte Queimada. 6. Caldeira Inferno

cross the Atlantic landed at Horta on 17 May 1919, proceeded to Ponta Delgada on 20 May, and reached Lisbon on 27 May. Later, when an Atlantic air-route was started, the American clippers began



138. *Horta and Monte da Guia*



139. *Horta from the north*



140. *Horta from the south*

to call regularly at Horta. On 31 August 1926 the town experienced a severe earthquake followed by a series of shocks. Lives were lost and great damage was done in the town and its neighbourhood, especially in the valley of the Flamengos.

Industry and Commerce. There are no noteworthy manufacturing industries in Horta. A small domestic manufacture of baskets, mats, and straw articles still survives, but the number of people engaged is insignificant. The former whale-oil industry is defunct at least for the present. There are an ice-plant and a few flour-mills in the town, and a lime-works in the western outskirts. The electric power-station, which supplies the town with lighting, is near the coal depot on the south quay.

During the year 1934 about 260 mechanically driven ships totalling 435,129 tons left the harbour at Horta. The cargo handled was small. The main exports were butter, cheese, cattle, and raw hides with very small quantities of corn, wheat, baskets, mats, straw ornaments, lace, osier, and articles made of dried fig-wood pith. The imports consisted largely of coal, timber, iron and steel goods, spices, paints, sugar, tea, and coffee.

Detailed Description. The Baia de Horta is about 2 miles long by 1 mile broad. It is the chief port of the central group of islands of the Azores, and being exposed only on the south-east forms one of the best anchorages in the archipelago. The sandy beach extends round the bay for about 1,300 yards from the ruined Forte de Lagoa to the Castello de S. Cruz, where a short stretch of rocky coast intervenes between the sands near the south quay (Fig. 55). For most of its length the beach is backed by a sea-wall which has openings at several cross-streets. In the bay a large fleet of vessels can anchor in 14 to 25 fathoms over sand, except in the north where anchorage is prohibited because of the numerous cables.

The port lies off the southern end of Horta and is formed by a combined mole and breakwater which extends north-north-eastwards from the foot of Monte Queimada. This breakwater is about 800 yards long and has a width of 20 to 30 feet. The inner harbour thus formed can shelter 10 to 15 large steamers, 4 alongside the breakwater and others moored to buoys, several of which are situated west of the breakwater in 6 to 8 fathoms. Ships up to 13,000 tons can enter and leave without difficulty. Spring tides rise 4 feet. Bollards and rings are fixed to the breakwater for mooring vessels alongside. The useful portion of the mole is about 1,500 feet long and has berths for 3 or 4 medium-sized ships in 24 to 54 feet. Although there are landing-steps

about midway along it, in actual practice ships nearly always anchor just off the mole and discharge and load cargo by means of lighters. The quays on the extreme south and south-west of the port (850 ft. and 450 ft. long respectively) handle the lighter traffic. They are shoal and can be used by lighters only, the facilities including several sets of steps and a few cranes. The coast between the south-west quay and Castello de S. Cruz is a sandy beach.

At times landing is difficult owing to heavy seas, and occasionally in winter waves break right over the mole which is 6 feet above normal high water.

There are no tugs at Horta, but several launches and open lighters (up to 35 tons) are available. A considerable stock of coal is maintained, coal being supplied in baskets from lighters or alongside the breakwater. Fresh meat, water, and a limited amount of vegetables can also be obtained.

Port Facilities. Repairs of an ordinary nature can be carried out. The coaling companies have workshops and repair shops, where small machine parts can be cast and minor repairs and oxy-acetylene welding are undertaken. It is said that castings up to 3 tons have been made. There is one small slipway for craft up to 60 tons.

Communications. From Horta a motorable road, 30 miles long, runs round the whole island serving all the main villages (Fig. 54). Two other roads climb inland towards the great Caldeira, both terminating within 6 or 7 miles of the port at an altitude of about 2,200 feet. There are 30 to 40 motor-cars in the town and a service by small buses is maintained to the larger villages. Ox-carts, however, are still much used for carrying goods.

The port has frequent steamship connexions with Lisbon, Madeira, and England (pp. 104-105). It has three radio-stations, one public and two government-owned (p. 350). Horta is one of the world's greatest cable centres, and normally there is telegraphic communication with all parts of the world (p. 110). The cables land on the beach near Forte de Lagoa on the north coast of the bay and on the shore near the cable huts at Porto Pim on the Baia de Pim (Photo. 136). The port is a regular stop on the Pan-American Airways clipper route from the U.S.A. to Europe and consequently has become an important distribution point for airmail.

Communications

The roads of Fayal are bumpy, winding, and narrow. The motorable roads are wide enough for two cars to pass slowly.

The most important road is the coastal road round the whole island (Fig. 54). From Horta this road runs south to Porto Pim, whence it pursues a westward course along the coast to the village of Feteiras (4 miles) and Castelo Branco (6 miles). The road passes continuously through profuse vegetation and follows the western coast to Ariciro (13 miles). From this point a branch circular road surrounds the Cabeço do Norte and the Cabeço del Fonte, passing through Capelas and rejoining the main road less than a mile north of Ariciro.

The road then goes through Praia do Norte, whence a branch road leads down steeply to the sea, and so along the north coast to Cedros (19 miles) and Salão (21 miles). South of Ribeirinha (25 miles) the road crosses one ridge to Pedro Miguel (26 miles), a second minor ridge and finally a third (the steepest), before reaching S. Amaro (29 miles) and Horta (30 miles).

Two roads find their way up the eastern slopes of Pico Gorda. Both of them go up the Flamengos valley from Horta and divide near Flamengos. The northern one then follows broad curves up to the head of the Flamengos valley, through trees, heather, and ferns, and partly over boggy open moor, and terminates near Arrochela (6-7 miles from Horta). The more southerly route makes the ascent nearly as far as Cangueiro.

FLORES

FLORES, the westernmost of the Azores, is about $10\frac{1}{2}$ miles long by $7\frac{1}{2}$ miles wide and has an area of about 57 square miles. The original name of the island on fourteenth-century maps was 'rabbit island' (Li Conigi). The Portuguese gave it the name of 'Flores' because of the flowers that abound in its ravines.

Physical Geography

The whole island is very mountainous, the highest summit being Morro Grande (3,087 ft.) in the north-west (Fig. 56). This crater is the dominant feature of the relief of the northern part of the island. To the south of it are several crater lakes which drain to the west coast, and Pico Caboco (2,467 ft.). In the east and south-east of the island are a number of peaks. To the east of Morro Grande is Pico da Se (2,369 ft.; Photo. 141), while to the east of Pico Caboco is Lombada Vaca (2,162 ft.). The eastern half of the island is deeply dissected by a number of torrents, most of which have falls at about 800 feet above sea-level. The whole of the island is well watered and is rich in hot springs, the best being near Ponta dos Ilheos in the south-west. The island is famous for its luxuriant flora and has plenty of timber. Hedges of hydrangeas grow to a height of 10 to 20 feet and masses of golden broom drape the cliffs.

The coasts of Flores are about 30 miles in length and consist mainly of cliffs, but there are several possible landing-places, especially on the east coast. The 4 miles of coast on the south between Ponta das Lagens and Ponta dos Ilheos are formed of low cliffs, broken by small streams at the eastern end, where the village of Lagens stands, and in the west near the low headland of Ponta dos Ilheos. The best landing-place is in the small bay of Lagens.

Alternating rocky headlands and sandy coves stretch along the 12 miles of coast on the west of the island from Ponta dos Ilheos to Ponta Delgada. Landing can best be effected on this coast south-east of the islet of Baixio Raza. From the steep bluffs which form the northern side of the island, the east coast extends southward as cliffs, but broken in places by small coves and the mouths of numerous streams. The best anchorage and landing-place is at Santa Cruz de Flores, situated midway along the eastern coast.

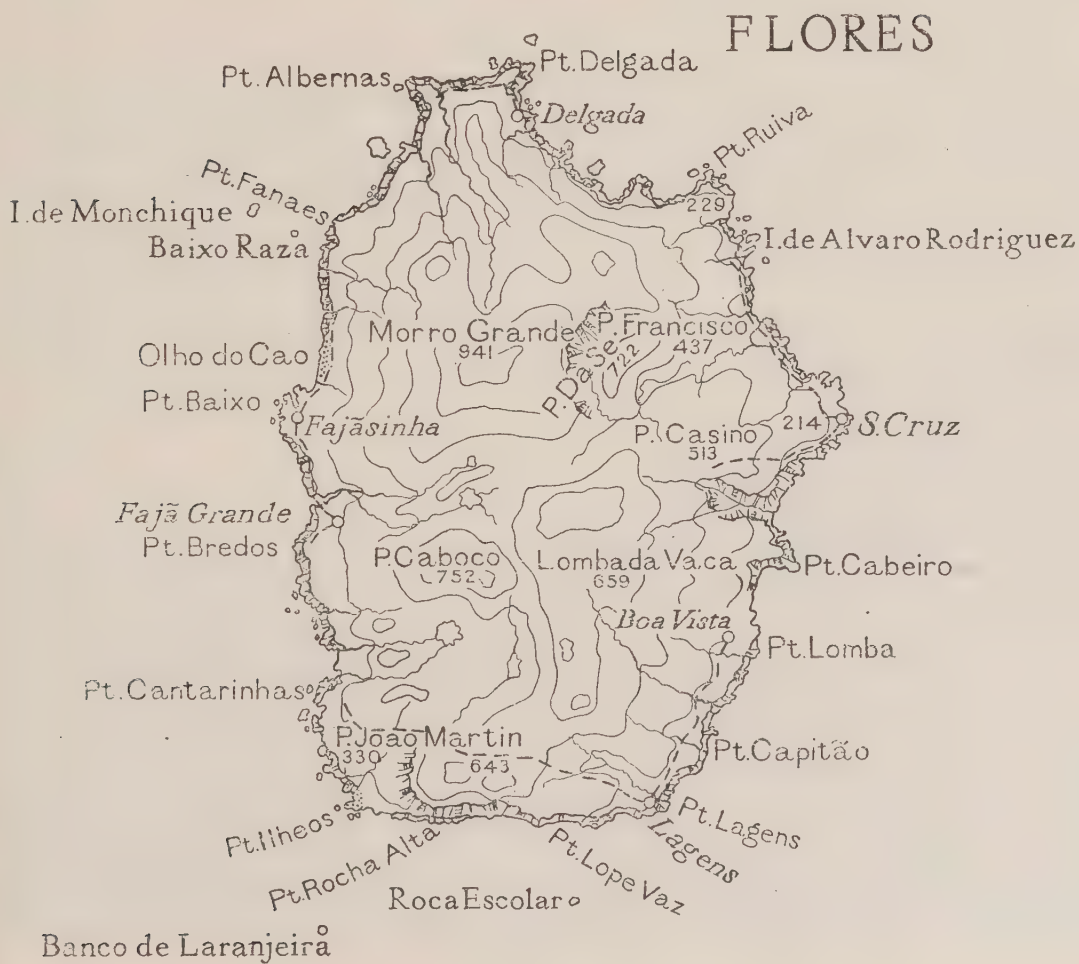
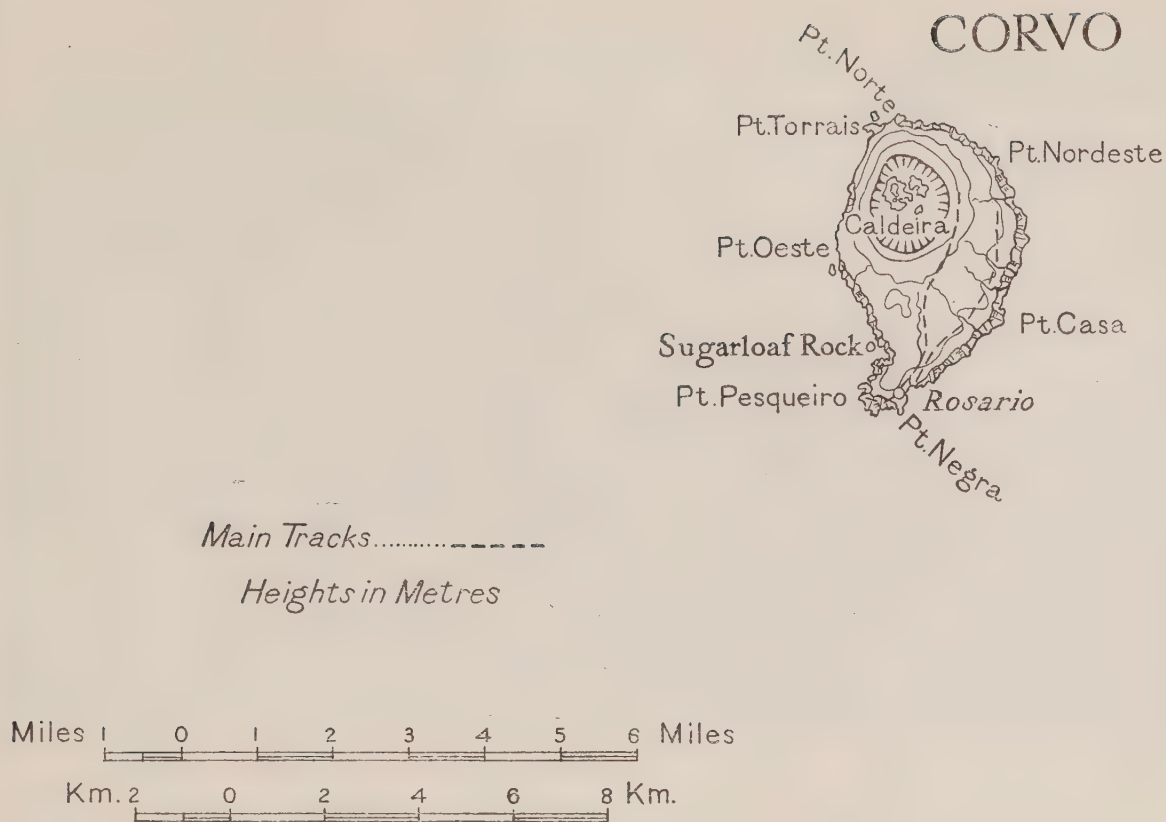


FIG. 56. Flores and Corvo
Relief shown by form lines

Human Geography

Flores has a lower density of population per square mile than any of the Azores except Corvo and Pico. The population of the island in 1930 was 6,999, of whom Santa Cruz could claim 2,076. This small town is the largest settlement and capital of the island. The place has an open harbour, a castle, a meteorological observatory, and several small baroque churches of the eighteenth century (Photo. 142). Lagens, north of Ponta das Lagens, with 845 inhabitants, is a village on the south-east of the island and has a good landing-place on the shore of a small rocky bay. On the west coast are the villages of Fajãsinha and Fajã Grande (Fig. 56).

The inhabitants of Flores are engaged in agriculture, cattle-raising, or fishing. Parts of the island are well cultivated, and potatoes, butter, and cattle are exported. Juniper trees buried beneath volcanic material are dug up and used for building the small craft trading between the islands.

The dissected nature of the country behind the principal settlements on the east coast makes communication and exploitation difficult. There are no roads, but tracks lead from the main centres of population. From Santa Cruz a track runs northward along the coast as far as Alvaro Rodriguez island, while another goes westward to the south of Pico Casino. A journey on muleback from Santa Cruz to the summit of Morro Grande is said to take 3 hours. From Lagens a track follows the coast northward to Boa Vista, while another track goes eastward to Ponta Cantarinhas. A track connects Fajã Grande with Fajãsinha and runs along the coast for some distance farther north.



141. *Pico da Se, Flores*



142. *S. Cruz, Flores*



143. *Corvo from the south*



144. *Rosario, Corvo*

CORVO

CORVO is the northernmost and the smallest of the Azores and is separated from Flores by a strait 12 miles in width. The island has been described as America's nearest European neighbour. Corvo is about $4\frac{1}{2}$ miles long by 3 miles broad with an area of about 7 square miles. Corvo has always borne, in substance, the same name, one of the oldest on the Atlantic, as it first occurs in a document written in 1350. The name is derived from the island's birds and means the 'sea-crow island'.

Corvo consists of a single volcanic mountain, the crater of which occupies the whole of the north-western part of the island. In the crater are two lakes in which are some islets. The rim of the crater is about $3\frac{1}{4}$ miles in circumference; its highest point is 2,548 feet in altitude (Fig. 56).

The island is surrounded by sheer cliffs which are particularly inaccessible in the north-west. The western coast, over 4 miles long from Ponta do Pesqueiro to Ponta do Norte, consists of cliffs of volcanic material which descend in terraces to the sea. At the north-westerly extremity of the island, Ponta do Torrais rises directly from the sea to the edge of the crater. The eastern coast, about $5\frac{1}{2}$ miles long, is steeply cliffed and has a fringe of rocks around it. The only possible landing-place on the island is in the south-east at the fishing-village of Rosario, which lies at the edge of a small cove (Photo. 143). Here there is a stony beach with no dangerous rocks near, but landing is often impracticable owing to surf.

The total population of this small and remote island was only 673 in 1930; nearly all the islanders live in Rosario, most of which is about 100 feet above sea-level (Photo. 144). The industries are fishing, agriculture, and the raising of a dwarf breed of cattle. Maize, wheat, and the vine are cultivated. Cheese and wine are said to be exported to other islands of the Azores. The country north of Rosario as far as the crater is divided into small and well-cultivated compartments by low stone walls. These small fields form narrow terraces, one above another, looking from the sea like steps in the hills. Above these terraces the volcano is covered with heath which affords pasturage for sheep and pigs.

There are no roads on Corvo, but two tracks leave Rosario, the one in a northerly, the other in a north-westerly direction. The former leads to the edge of the crater, while the latter follows the eastern

coast of the island. There is a fortnightly steamship service between Corvo and the other islands, but the service is often suspended, especially in winter, because of wind and swell making landing at Rosario impossible. The latter town has a radio station.

APPENDIXES

- A. RECENT VOLCANIC AND SEISMIC ACTIVITY IN THE AZORES
- B. METEOROLOGICAL TABLES
- C. EXTERNAL TRADE OF THE CANARIES
- D. WIRELESS AND RADIO STATIONS IN THE CANARIES, MADEIRA, AND THE AZORES
- E. BIBLIOGRAPHICAL NOTE

APPENDIX A

VOLCANIC AND SEISMIC ACTIVITY IN THE AZORES

THE following list includes the principal eruptions and earthquakes recorded during the past five centuries.

S. MIGUEL

- 1444 or 1445 Explosive eruption with ejection of much pumice in the Caldeira das Sete Cidades.
- 1522 Severe earthquake; no eruption recorded. Vila Franca was overwhelmed by a great landslip, a hill some 450 yards from the beach sliding down upon the town, the rush of earth being followed by tumultuous streams of water and the work of destruction being completed by a tidal wave.
- 1563 Great eruption at Lagoa do Fogo. Earthquakes and eruptions, especially of cinders, lasted a whole month. Hot springs at Furnas first made their appearance.
- 1564 Smaller eruption at Lagoa do Fogo.
- 1591 Severe earthquakes; Vila Franca largely destroyed; tidal wave washed over Povoação and swept away much of village.
- 1630 Great eruption in Furnas valley and formation of a crater. Vila Franca and other towns suffered severely from earthquakes, and part of the island was buried under from 5 to 17 feet of volcanic dust.
- 1652 Basalt lava-flow from Pico do Fogo, formed the rocky slope along coast at north-east of island.
- 1656 Severe earthquakes.
- 1682 Earthquakes.
- 1713 Severe earthquakes.

Between 1713 and 1884 there were ten earthquakes of moderate to severe intensity, not including those of submarine origin.

TERCEIRA

- 1547 Severe earthquake.
- 1614 Severe earthquake destroyed Praia da Victoria.
- 1760/1 Earthquakes followed by lava eruption near Pico Gordo; built ash and cinder cone of Pico da Bagacina.
- 1800 Earthquakes.
- 1801 Earthquakes.
- 1841 Earthquakes again destroyed Praia da Victoria.

S. JORGE

- 1562 Severe earthquakes at Vellas (*see* Pico).
- 1580 Great eruption east of Vellas with much ash and lava-flows, and building of large cinder cones.
- 1757 Violent earthquakes possibly due to submarine eruption.
- 1808 Eruption with much ash and lava on south side of Pico da Esperanza.

PICO

- 1562 Great eruption lasting for many months, with lava-flows near Prainha do Norte and Ponta do Misterio.
- 1718 Great and frequent eruptions (said to number 20 during the year) on the flanks of Pico and especially between S. Mateus and S. João, and S. Luzia and Bandeiras, with many lava-flows and the building of several large cinder and scoriae cones.
- 1720 Great lava-flow on south side at Soldão near Lagens.
- 1926 Earthquakes (*see* Fayal).

FAYAL

- 1672 Eruptions, with large lava-flows and formation of Pico do Fogo.
- 1759/60 Violent earthquakes.
- 1862/3 Severe earthquakes.
- 1926 Severe earthquakes did much damage and caused some casualties in Horta and in neighbouring villages near the south-east coast and especially in the Flamengos valley.

This was the last great earthquake in Fayal, but slight tremors are felt every year and at times are very frequent.

FLORES

- 1793 Severe earthquake, the only one recorded on the island.

SUBMARINE ERUPTIONS

The following submarine eruptions have been recorded since 1538:

- 1538 Three miles north-west of Ponta da Ferraria in S. Miguel, formed a large islet of loose material, 360 feet high, which was soon washed away and replaced by a shoal 240 feet deep.
- 1683 Between Ponta da Ferraria and Terceira island, a severe eruption which formed a bank of floating pumice that hindered shipping for a long time.
- 1720 Between S. Miguel and Terceira, built up an island that lasted until 1723.
- 1758 North-east of S. Jorge, revealed by several earthquakes. Supposed to have formed 18 islets.
- 1811 (Feb.) Two and a half miles east of Ponta da Ferraria, built an island 40 feet long and 33 feet high.

- 1811 (June) A mile west-south-west of Ponta da Ferraria, built Sabrina island, that attained a height of about 300 feet and a circumference of 2,000 yards; this island had quite disappeared by Feb. 1812.
- 1857 $39^{\circ} 57' N.$, $25^{\circ} 50' W.$: a minor eruption.
- 1867 $38^{\circ} 45' N.$, $38^{\circ} 05' W.$: off Ponta do Queimado, Terceira; ejected pumice and scoriae, but did not build an island.
- 1902 Between Terceira and Pico, about 15 miles south of site of eruption of 1867, cable broke following a submarine eruption.
- 1907 Nine miles south of Ponta da Ferraria, cable broke following a submarine eruption.

Since this year sea cables have broken on several occasions after submarine volcanic and seismic activity.

APPENDIX B. METEOROLOGICAL TABLES

TABLE I

THE CANARIES

OROTAVA (LA PAZ BOTANICA). Lat 28° 25' N., Long. 16° 32' W. Height 328 feet.

Month	Pres- sure at M.S.L.* Mean	Air temperature				Relative humidity	Cloud amount scale 0-10		Rain		Wind direction																				
		Mean of					7 a.m.	2 p.m.	No. of days with 0.04 in. or more	Percentage of observations from																					
		Absolute								7 a.m.																					
		Daily max.	Daily min.	Highest	Lowest	Highest	Lowest	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm						
January	mb. 1022	° F. 65	° F. 54	° F. 73	° F. 50	° F. 77	° F. 48	4.4	4.9	8	2	4	81	2	4	0.7	0.7	5	16	35	4	1	2	3	3	12	19	8			
February	1021	65	54	73	50	86	48	4.5	5.4	6	1	4	77	1	4	2	0	8	19	47	4	0.9	2	3	3	9	13	4			
March	1019	66	55	76	51	88	47	5.9	6.3	7	2	3	61	2	10	6	0	7	14	48	2	0	0.6	9	11	14	5				
April	1019	67	56	73	52	83	49	6.1	6.5	2	2	0	46	5	5	3	0.3	18	22	57	5	0.3	0	2	7	5	2				
May	1019	69	58	72	54	74	52	6.5	6.7	3	1	1	28	2	11	5	0	21	12	71	4	0	1	0	6	4	5				
June	1020	71	61	74	57	83	55	5.9	6.0	0.7	4	4	19	0.7	4	2	0.7	16	24	64	5	0	0	0	0	2	1	4			
July	1019	73	64	76	60	77	57	6.1	5.1	0.1	0.9	40	8	17	0	3	0	29	13	80	4	0	0	0	0.4	2	1	4			
August	1018	76	66	80	63	90	60	5.3	4.5	0.1	0.7	27	7	10	2	8	0.3	30	14	75	1	0	0	0.3	3	6	1	1			
September	1019	76	65	82	60	93	58	4.2	5.0	2	0	9	48	3	4	1	0	30	20	61	2	0.3	0.3	0.4	3	8	9	5			
October	1019	74	63	82	59	94	55	4.7	5.6	6	0	6	5	6	3	0.7	0.3	15	16	51	0.7	1	0.3	2	8	14	2	7			
November	1019	70	60	77	55	86	52	5.6	5.8	8	0	2	2	75	5	4	1	8	13	40	3	1	0.7	3	12	12	15	15			
December	1021	67	56	74	51	79	47	4.5	5.0	6	0.3	3	2	84	2	3	0.7	5	15	36	1	0.7	2	4	8	16	17	17			
Means	1020	70	59	88	49	94	47	5.3	5.6	—	0.7	15	6	52	3	5	2	16	17	55	3	0.4	0.7	2	7	9	6	—			
Totals	—	—	—	—	—	—	—	—	—	51	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
No. of yrs. obsns.	33	1905-13										1905-13										1905-13									

Hours of observations: 0700, 1400, 2100, Local Time.

* Mean of observations at 0900 and 1500 taken at Las Palmas, 28° 07' N., 15° 26' W., 39 feet.

TABLE 2

MADEIRA

FUNCHAL. Lat. 32° 38' N., Long. 16° 54' W. Height 82 feet. Compiled from observations, 1901-1938.

Month	Pres- sure at M.S.L. Mean	Air temperature				Relative humidity		Cloud amount scale 0-10		Rain		Wind direction												No. of days with gale	No. of days with fog or mist							
		Mean of				9 a.m.		3 p.m.		No. of days with trace or more		Percentage of observations from 9 a.m.						Percentage of observations from 3 p.m.														
		Daily max.	Daily min.	Highest	Lowest	9 a.m.	3 p.m.	Average fall	No. of days	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	N.	NE.	E.	SE.	S.			SW.	W.	NW.	Calm			
		° F.	° F.	° F.	° F.	%	%	in.	8	14	8	7	8	6	8	7	7	35	3	6	9	23	16			19	11	2	11	knots		
January	mb.	65	53	70	49	65	62	7.1	6.2	2.7	8	14	8	7	8	6	8	7	35 <td>3</td> <td>6</td> <td>9</td> <td>23</td> <td>16</td> <td>19</td> <td>11</td> <td>2</td> <td>11</td> <td>3.3</td> <td>0</td> <td>2</td>	3	6	9	23	16	19	11	2	11	3.3	0	2	
February	1020	65	52	69	48	63	62	7.0	6.2	3.4	7	12	8	7	9	5	9	7	37	5	4	10	20	20	21	10	3	7	4.2	0.2	2	
March	1017	65	53	72	49	62	61	6.9	5.9	3.1	7	5	2	5	11	12	13	12	36	3	3	5	13	22	28	16	3	7	3.7	0.1	2	
April	1017	66	54	72	50	63	61	7.1	6.3	1.7	6	3	2	5	17	21	18	9	2	23	2	4	21	29	25	25	1	5	3.2	0	1	
May	1017	68	57	74	53	63	62	6.8	5.9	0.9	4	2	1	4	17	26	22	6	0.9	21	2	1	15	34	31	7	0.9	6	3.1	0.1	1	
June	1018	71	60	77	56	65	63	6.6	5.8	0.3	2	0.9	0.9	1	15	31	30	4	0.2	17	0.6	0.8	1	11	38	39	6	0	4	2.9	0	1
July	1018	74	63	79	60	65	64	6.0	5.1	0.1	1	0.7	0.1	2	15	36	27	2	0	17	0.6	0.7	0.4	8	44	41	2	0.4	3	2.7	0	0.2
August	1017	77	65	84	62	64	63	5.5	4.3	0.1	1	0.7	0.9	1	11	29	23	2	0.3	32	0.3	0.4	1	7	40	39	3	0.4	9	2.8	0	0.1
September	1017	76	65	82	61	64	64	6.0	5.4	1.0	4	2	2	3	13	23	17	5	2	33	3	1	2	13	35	30	8	2	6	2.9	0	1
October	1016	74	62	80	57	64	64	5.9	5.0	3.7	9	7	4	4	11	15	12	6	2	39	3	3	6	18	28	22	10	2	8	2.9	0	2
November	1017	70	58	75	53	64	64	7.2	6.3	4.9	9	8	6	9	11	8	9	8	4	37	5	6	7	16	21	22	11	3	9	3.1	0.1	2
December	1020	67	55	72	51	65	64	7.1	6.3	3.5	8	18	7	7	10	5	5	6	6	36	5	6	12	22	14	17	11	2	11	3.1	0.1	2
Means	1018	70	58	—	—	64	63	6.8	5.8	—	—	6	3	5	13	18	16	6	3	30	3	3	5	16	28	27	9	2	7	3.1	0.6	—
Totals	—	—	—	—	—	—	—	—	—	25.4	66	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	16
Extreme Values.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' observations	30		1916-1922; 1924; 1929-1938																		10	20	30									

Hours of observations: 0900, 1500, and 2100 Local Time.

* Mean of observation 0900, 1500 and 2100 Local Time.

§ Highest recorded temperature.

|| Lowest recorded temperature.

TABLE 3

THE AZORES

PONTA DELGADA. Lat. 37° 44' N., Long. 25° 40' W. Height 118 feet. Compiled from observations, 1894-1938.

Month	Pres- sure at M.S.L. Mean	Air temperature				Relative humidity		Cloud amount 0-10 scale		Rain		Wind direction								*No. of days with gale	†No. of days with fog		
		Mean of										Percentage of observations from											
		Daily max.	Daily min.	Highest	Lowest	6 a.m.	4 p.m.	Average fall	No. of days with 0.1 in. or more	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm					
January	mb. 1022	° F. 62	° F. 55	° F. 65	° F. 48	% 79	% 76	7.0	7.6	in. 3.0	15	10	14	7	10	16	17	11	9	6	knots 8.7	5	1
February	1020	61	54	64	48	77	73	7.3	7.2	2.9	14	10	14	6	9	15	18	14	9	5	8.7	4	1
March	1020	62	54	65	48	77	73	7.6	7.3	2.5	13	12	16	5	9	11	17	14	10	6	7.6	4	1
April	1021	63	55	67	50	77	71	7.4	7.0	2.1	11	12	19	6	10	11	16	12	8	6	7.0	3	1
May	1021	66	58	70	53	80	73	8.8	6.7	2.1	11	13	18	3	7	11	16	14	8	10	5.9	1	0.1
June	1023	70	62	75	57	81	72	7.2	6.4	1.3	8	12	21	4	7	10	16	13	5	12	4.9	0.4	0.1
July	1024	75	66	78	61	81	71	6.5	6.0	0.8	7	14	25	5	7	7	12	11	5	14	4.3	0.1	0.4
August	1023	77	67	80	63	81	70	5.7	5.8	1.4	8	12	22	4	7	9	15	11	4	16	3.7	0.4	0
September	1021	74	66	78	61	80	72	6.0	6.2	2.5	12	15	21	5	9	10	13	9	8	10	4.9	1	0
October	1019	70	64	74	57	80	74	6.9	6.6	3.3	14	15	21	7	8	11	12	10	8	8	6.4	3	0.1
November	1020	66	59	70	53	78	75	7.0	7.0	3.4	15	14	19	8	9	9	12	12	10	7	7.0	3	0.4
December	1021	64	57	67	50	79	76	7.0	7.3	3.2	15	11	14	6	8	14	18	13	10	6	8.7	5	1
Means	1021	68	60	80†	46§	79	73	6.9	6.8	—	—	12	19	6	8	11	15	12	8	9	6.5	—	—
Totals	—	—	—	—	—	—	—	—	—	28.5	143	—	—	—	—	—	—	—	—	—	—	29	6
Extreme values	—	—	—	83||	42¶	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No. of years' obser- vations	45	43				15				43	45	45								33	34	8	—

Hours of observation, 0600, 1100, 1600, and 2200, 30° W. Local Time.

* Wind speed 32 knots or more.

§ Mean of lowest each year.

† Days on which visibility falls below 1,100 yds. at any time in the day.

¶ Mean of highest each year.

|| Lowest recorded temperature.

APPENDIX C

EXTERNAL TRADE OF THE CANARIES, 1933

IMPORTS

<i>Type of goods</i>	<i>Quantity (metric tons)</i>	<i>Value (1,000 pesetas gold)</i>
Building stones	101,628	4,080
Coal	163,975	3,978
Petrol and oils	594,600*	29,374
Pottery	5,747	2,165
Timber	6,980†	4,639
Wood manufactures	32,245	4,402
Livestock	824‡	189
Hides and skins	233	1,826
Iron and steel	8,000	2,204
Hardware	6,376	5,867
Machinery	1,173	2,982
Automobiles, &c.	797	2,140
Dyes and stains	420	607
Perfumes and essences	100	502
Sulphur	2,440	365
Pure chemicals	4,104	1,256
Artificial manures	45,451	4,482
Paper and its manufactures	5,013	2,329
Cotton goods	891	4,255
Other fabrics and yarns	279	422
Sandals	562	770
Wool and woollen manufactures	69	948
Silk and silk manufactures	103	780
Poultry, meat, and fats	855	907
Fish, fresh, salted, and cured	1,609	973
Cereals and flour	88,677	10,938
Dried vegetables	8,214	1,606
Potatoes	15,379	1,541
Sugar	10,424	3,231
Coffee beans	1,651	1,551
Olive oil	1,883	1,644
Alcoholic drinks	2,129	2,051
Wines	2,764	606
Other beverages	1,497	791
Seeds and forage	46,654	1,721
Conserves	2,128	2,413
Rubber goods	460	1,458
Matches	395	1,026
Tobacco	1,845	3,450
TOTAL IMPORTS	1,168,574	116,469

* Consisting of	<i>tons</i>		<i>tons</i>
Petrol	10,785	Lubricating oil	2,146
Illuminating oils	12,930	Crude oil	148,896
Diesel oil	127,062	Fuel oil	291,331

† Statistics for 1930. ‡ Head of livestock.

EXPORTS

<i>Type of goods</i>	<i>Quantity (metric tons)</i>	<i>Value (1,000 pesetas gold)</i>
Petrol and lubricating oil	71,617*	3,156
Wood manufactures	1,356	1,262
Hides and skins	220	281
Metal containers	1,662	566
Cochineal	151	487
Cotton goods	25	260
Fish, fresh and cured	6,457	4,677
Fish conserves	568	552
Potatoes	5,549	997
Tomatoes	92,020	19,379
Bananas	158,753	42,709
Tobacco (manufactured)	794	439
Onions	148	?
Almonds	109	?
TOTAL EXPORTS	339,429	74,765

*Consisting of	<i>tons</i>
Petrol	26,233
Illuminating oils	6,627
Diesel oil	9,915
Lubricating oil	12
Crude oil	133
Fuel oil	28,297

APPENDIX D

WIRELESS (W/T) AND RADIO (R/T) STATIONS IN THE CANARIES, MADEIRA AND THE AZORES IN SEPTEMBER 1942

<i>Station</i>	<i>Approximate position (longitude and latitude)</i>	<i>Power (where known) in kW.</i>	<i>Frequencies kc/s.</i>	<i>Details</i>
THE CANARIES: GRAN CANARIA				
Las Palmas (S. Lorenzo)	15° 35' W. 28° 00' N.	One 0·25 Eight 10	1,875 6,870 6,895 9,820 13,790 14,820 14,940 14,965 15,065	Commercial station of Transradio Española. H/F services, telegraphy and radio telephony, with Spain (Aranjuez and Barcelona), Dakar, and internal. Also long-distance H/F services to shipping. On frequencies of 4,150 (night) and 6,400 (day) acts as naval station and gives services to other Spanish naval stations and warships.
"	15° 28' 40" W. 28° 07' 06" N.	Four 2	375 425 454 500	Coast station of Transradio Española. Public correspondence only.
"	15° 30' W. 28° 6' N.	..	333 5,500 11,111	Military air station. Point-to-point services with other S.A.F. stations. Collecting station for meteorological reports.
"	"	..	..	Military station of the Civil Guard. Communicates with Tenerife and main Civil Guard stations in Spain.
Gando	15° 22' W. 27° 55' N.	Four 0·5 Four 0·1	238 323 333 345 500 5,500 6,000 8,108 11,111 11,528 12,500	Aeronautical station, used exclusively for official correspondence. Appears also to be area headquarters of military aircraft in the Canaries.
TENERIFE				
S. Cruz	16° 15' 00" W. 28° 28' 30" N.	Four 0·3 One 0·25	375 410 454 500 1,765	Transradio Española. Coast service to shipping and commercial service to interior.
"	"	..	..	Military station of the Civil Guard. Communicates with Las Palmas and the main Civil Guard stations in Spain.
S. Cruz (Los Rodeos)	"	..	333 5,500	Military air station with service to Gando and Ifni.
El Tablero (2 stations)	16° 15' 38" W. 28° 26' 30" N.	Seven 5 One 0·3	5,140 5,855 6,480 6,800 10,090 10,370	Coast and commercial station of Spanish National Telephone Company. Commercial services (H/F and R/T) to Spain and long-distance services with shipping. Coast service (R/T) for

Station	Approximate position (longitude and latitude)	Power (where known) in kW.	Frequencies kc/s.	Details
La Laguna-S. Roque	16° 15' 31" W. 28° 28' 30" N.	..	16,300	public correspondence for long-distance communications between the land-system and ships at sea outside the Spanish coast zone. Also a naval station with service to other Spanish naval stations and warships. Coast station for official correspondence. Meteorological bulletins.
			16,330	
			150	
			273	
			375	
			500	

THE MADEIRA GROUP: MADEIRA*

Funchal	16° 54' 58" W. 32° 38' 19" N.	.. Two 0·01	3,750	Government and commercial station of the Portuguese Navy Department (Radio-Telegraph Marine). For official correspondence and meteorological bulletins. Fixed service with Lisbon and Monsanto. May also communicate with Newfoundland.
			7,389	
			7,500	
			9,090	
			10,000	
			11,538	
„	„	Four 0·5	125	Coast station for official correspondence only.
			143	
			395	
			500	
Ponta do Garajão	16° 51' 10" W. 32° 37' 30" N.	One 1·25 Four 0·5	110	Government and commercial station under the administration of the Cia. Portuguesa Rádio-Marconi. Fixed service for public correspondence only, with Lisbon and Azores. Has also had irregular communication with Brazil.
			5,030	
			5,765	
			9,475	
			9,495	
„	„	Four 0·75	130	Coast station for public correspondence and for communicating with ships.
			143	
			425	
			500	
„	„	Two 0·75	333	Civil air station, communicating with aircraft; for public correspondence only.
			500	

* Naval and Military stations are not included.

PORTO SANTO

Vila Baleira	16° 19' 30" W. 33° 03' 30" N.	.. One 0·5	411 500	Government and commercial station operated by the Portuguese Post Office Department. Fixed service with Madeira. Also communicates with ships.
--------------	----------------------------------	---------------	------------	--

THE AZORES: S. MIGUEL

Ponta Delgada	25° 39' 30" W. 37° 44' 50" N.	Two 2 Five 0·5	105 107·5 6,925 9,055 11,915 11,925 11,930	Government and commercial station operated by Cia. Portuguesa Rádio-Marconi. Fixed services to Portugal and Madeira.
„	„	Three 0·75	136 143 417 500	

<i>Station</i>	<i>Approximate position (longitude and latitude)</i>	<i>Power (where known) in kW.</i>	<i>Frequencies kc/s.</i>	<i>Details</i>
THE AZORES: S. MIGUEL (cont.)				
Ponta Delgada	25° 39' 30" W. 37° 44' 50" N.	..	333 500	Civil aeronautical station for public correspondence only.
"	25° 41' 20" W. 37° 44' 15" N.	..	1,770	Post Office Department station for public correspondence with other islands of Azores.
SANTA MARIA				
Vila do Porto	25° 08' 42" W. 36° 56' 50" N.	..	1,905	Government and commercial station of Post Office Department. Fixed service for inter-island public correspondence.
TERCEIRA				
Angra do Heroísmo	27° 13' 55" W. 38° 39' 00" N.	..	1,905	"
S. JORGE				
Porto das Vellas	28° 12' 36" W. 38° 40' 42" N.	..	2,805	"
PICO				
Magdalena	28° 31' 42" W. 38° 32' 00" N.	..	2,085	"
FAYAL*				
Horta	28° 37' 42" W. 38° 32' 18" N.	..	1,995	"
"	28° 38' 04" W. 38° 31' 39" N.	Two 0.25	9,725 13,129	Headquarters station of Portuguese Navy Department in the Azores. Operated by Radio-Telegraph Marine. Fixed service for official correspondence only with Portugal and Madeira.
"	"	One 0.5	123	Commercial coast station for official correspondence and meteorological bulletins.
		..	143	
		..	390	
			394	
"	28° 37' 59" W. 38° 32' 18" N.	One 1.5	9,725 ..	Naval meteorological station of Radio-Telegraph Marine. Primarily serves Atlantic air-lines but forecasts also given to shipping. Does S.O.S. service for sea or air on international frequencies; W/T communications between bases in Europe and America. Can also communicate with any part of Africa.
"	28° 40' 25" W. 38° 31' 42" N.	..	375 500	Direction-finding station operated by Radio-Telegraph Marine.
"	"	Normal range of 200 nautical miles.	294.5	Radio beacon and fog signal stations of Radio-Telegraph Marine.
GRACIOSA				
S. Cruz	28° 00' 36" W. 39° 05' 10" N.	..	2,085	Government and commercial station of Post Office Department. Fixed service for inter-island public correspondence.

* All the radio installations of the Portuguese Navy Department (Radio-Telegraph Marine) on Fayal island are inter-connected by automatic telephone.

<i>Station</i>	<i>Approximate position (longitude and latitude)</i>	<i>Power (where known) in kW.</i>	<i>Frequencies kc/s.</i>	<i>Details</i>
FLORES				
S. Cruz	31° 08' 10" W. 39° 27' 35" N.	..	2,185	Government and commercial station of Post Office Department. Fixed service for inter-island public correspondence.
Lagens	31° 11' 18" W. 39° 22' 30" N.	One 0.2	375 500 1,648	Commercial coast station of Radio-Telegraph Marine. Used exclusively for official correspondence.
"	"	..	294.5 333 500	Civil aeronautical station for official correspondence only.
"	"	..	294.5	Radiobeacon and Fog signal stations.
CORVO				
Rosario	31° 07' 35" W. 39° 40' 10" N.	..	2,235	Government and commercial station of Post Office Department. Fixed service for inter-island public correspondence.

APPENDIX E

BIBLIOGRAPHICAL NOTE

ALTHOUGH a large number of English books of varying quality have been written about the Atlantic islands, no comprehensive geographical account of the three groups has yet appeared in the English language except in the form of a guide-book. No Geographical Handbook of the Atlantic islands was published in the old series of Handbooks during the War of 1914-1918. There are few recent books or articles about the Azores.

In the compilation of this volume considerable assistance was received from the War Office, the Air Ministry, the Foreign Office Research Department, and the Ministry of Economic Warfare.

A useful general bibliography of 1,148 items concerning the Atlantic islands is *Bausteine zu einer Bibliographie der Canarischen, Madeirischen und Capverdischen Inseln und der Azoren* (1929) by Dr. Julius F. Schütz.

The following list includes some of the books and articles that were found especially useful in the preparation of this volume. The list is not in any sense a complete guide to the geographical literature concerning the islands.

GENERAL

- A. SAMLER BROWN. *Brown's Madeira, Canary Islands and Azores* (14th ed. 1932). This is the most complete guide-book.
- FINDLAY MUIRHEAD (ed.). *Southern Spain and Portugal* (1929). Blue Guides Series. This includes a section on Madeira, the Canary Islands, and the Azores.
- K. BAEDERER. *Madeira, Canary Islands, Azores, Western Morocco* (1939).

The Canaries

- E. PÉGOT-OGIER. *The Fortunate Isles*. 2 vols. Translated by F. Locock (1871).
- O. M. STONE. *Tenerife and its six Satellites* (1889).
- L. PROUST and J. PITARD. *Les Îles Canaries. Description de l'Archipel* (1909).
- Canary Islands*. Handbook prepared under the direction of the historical section of the Foreign Office. No. 123 (1920).
- DAVID A. BANNERMAN. *The Canary Islands. Their History, Natural History and Scenery* (1922).
- GERTRUD TITTELBACH. *Beiträge zur Landschaftskunde von Teneriffa* (1931). This detailed study contains a bibliography of 88 items.

The Madeira Group

- T. E. BOWDICH. *Excursions in Madeira and Porto Santo* (1825).
 M. C. GRABHAM. *The Climate and Resources of Madeira* (1870).
 A. J. DREXEL BIDDLE. *The Madeira Islands*. 2 vols. (1900).
 W. H. KOEBEL. *Madeira Old and New* (1909).
 C. A. LE P. POWER. *Power's Guide to the Island of Madeira* (3rd ed. 1935).
 W. HARTNACK. *Madeira Landeskunde einer Insel* (1930). This work contains a bibliography of 423 items.
 F. A. DA SILVA. *Dicionário Corográfico do Arquipélago da Madeira* (1934).

The Azores

- R. SWINDELLS. *A Summer Trip to the Island of St. Michael, the Azores* (1877).
 W. F. WALKER. *The Azores: or Western Islands* (1886).
Azores and Madeira. Handbook prepared under the direction of the historical section of the Foreign Office. No. 116 (1920).

PHYSICAL GEOGRAPHY AND GEOLOGY

- C. GAGEL. *Die mittelatlantischen Vulkaninseln*. Handbuch der regionalen Geologie, vii, Bd. 10 (1910).
 I. FRIEDLAENDER. 'Die Azoren', *Zeitschrift für Vulkanologie*, xii (1929-1930), pp. 77-107.

The following three older works are still valuable for their physical descriptions of some of the islands:

- A. VON HUMBOLDT. *Personal Narrative of Travels to the Equinoctial Regions of America during the years 1799-1804* (edition of 1852).
 LEOPOLD VON BUCH. *Description physique des Îles Canaries* (1836).
 C. LYELL. *Principles of Geology* (12th ed. 1875).

CLIMATE

- J. HANN. Articles on the climate of the Canaries and the Azores in *Met. Zeitschrift*, ix (1891); xiv (1897); xvii (1900); xviii (1901); xxi (1904); xxiii (1906); xxiv (1907); xxvii (1910).
 G. SCHOTT. *Geographie des Atlantischen Ozeans* (1926).
 A. LOHR. 'Beiträge zur Flugmeteorologie der Azoren', *Archiv Deut. Seewarte*, lviii (1938), No. 5.
Africa Pilot. Part I (10th ed. 1939).

VEGETATION

- P. B. WEBB and S. BERTHELOT. *Histoire naturelle des Îles Canaries*. 3 vols. and atlas (1836-50).
 F. DU C. GODMAN. *Natural History of the Azores* (1865).

VEGETATION (*cont.*)

- R. T. LOWE. *A Manual Flora of Madeira and the adjacent islands of Porto Santo and the Desertas* (1868).
- J. Y. JOHNSON. *Madeira* (1885).
- H. CHRIST. 'Vegetation und Flora der Kanarischen Inseln', Engler's *Botanische Jahrbücher* (1885).
- C. BOLLE. 'Flora insularum . . . Lanzarote et Fuerteventura', Engler's *Botanische Jahrbücher* (1892).
- M. VAHL. *Madeira's Vegetation* (1940).
- H. B. GUPPY. *Plants, Seeds and Currents in the West Indies and the Azores* (1917).
- A. CHOPARD. 'Aperçu sur la flora et la fauna des Açores', *Bull. Soc. de Biogéographie* (1931).
- M. GRABHAM. *Plants seen in Madeira* (1934).

FAUNA

Some of the general books given above under 'Vegetation' deal with fauna. For birds see especially D. A. BANNERMAN, *The Canary Islands* (1922).

HISTORY AND PEOPLE

- GOMES EANNES DE AZURARA. *The Chronicle of the Discovery and Conquest of Guinea*. Translated and edited by C. R. Beazley and E. Prestage. Hakluyt Society, 1st series, vol. xcv (1896) and vol. c (1898).
- PIERRE BONTIER and JEAN LE VERRIER. *The Canarian or Book of the Conquest and Conversion of the Canarians in the year 1402 by Jean de Bethencourt*. Translated and edited by R. H. Major. Hakluyt Society, 1st series, vol. xlvi (1871).
- A. DA CADAMOSTO. *The Voyages of Cadamosto*. Translated and edited by G. R. Crone. Hakluyt Society, 2nd series, vol. lxxx (1937).
- A. DE ESPINOSA. *The Guanches of Tenerife with the Spanish Conquest and Settlement*. Translated and edited by Sir Clements Markham. Hakluyt Society, 2nd series, vol. xxi (1907).
- JOHN H. VAN LINSCHOTEN. *The Voyage of John Huyghen van Linschoten to the East Indies*. Edited by A. C. Burnell and P. A. Tiele. Hakluyt Society, 1st series, vols. lxx-lxxi (1884).
- E. PRESTAGE. *The Portuguese Pioneers* (1933).
- A. L. ROWSE. *Sir Richard Grenville of the Revenge* (1937).

ECONOMIC GEOGRAPHY

- S. JENSEN. 'Agricultural methods on the Canaries: Fuerteventura and Lanzarote', *Economic Geography*, x (1934), pp. 99-108.
- Anuario Estadístico de España* (Madrid). Annual publication.
- Anuário Estatístico de Portugal* (Lisbon). Annual publication.

INDEX

- Abona, Puerto, 155.
 —, Punta de, 148.
 acacia, 277, 278.
 Acentejo, La Victoria de, 146.
 acequia, 195, 196.
 Achada, 274.
 Achadas da Cruz, 251.
 — das Furnas, 278, 298.
 Achadinha, 298.
 Adeje, 15, 147, 155.
 Aduares, barranco, 180.
Aeonium canariense, 170.
aforamento, 286.
 Agaete, 57, 119, 121, 123, 126; popula-
 tion, 128; roads, 139.
 —, barranco de, 123.
 agapanthus, 41.
 Agrícola de Arafo, galería, 146.
 Agua d'Alto, 297; hydro-electric station,
 293.
 — de Bueyes, 196, 203.
 — de Pau, 282, 287; roads, 296, 297,
 300.
 — — —, Serra de, 275.
 — de Pena, 254.
 — Mansa, electric station, 167.
 —, Serra de, 19, 233, 240, 253.
 — Tona, 141.
 Aguajada, barranco de, 174.
 Aguajillo, 176.
 —, barranco, 172, 176.
 Agualva, 23, 304.
 Agüimes, 122, 127; roads, 139, 141.
 —, barranco de, 126, 127, 128.
 Agujas, Montaña de las, 216.
 Agulo, 172, 174, 175.
 Ajala, Antonio de, 59.
 Ajuda, 281.
 —, Ponta da, 281.
 Alajero, 171, 173, 174; roads, 176.
 albacora, 289.
 Alcaçovas, treaty of, 57.
 Alcala, 147.
 Alcaraveras, 15.
 Aldea de S. Nicolás, 121, 123, 128, 139,
 140.
 — — —, barranco de, 19, 128.
 Alegranza island (Canaries), 20, 78, 218;
 description, 219-20; fishing, 134.
 alfalfa, 200, 212.
 Algarve, the, 269.
 Almeida, barranco de, 160.
 Almirante Reis, Campo do, 243.
 almond, 44, 127, 130, 133, 136, 151,
 158, 172, 182, 184, 188, 190, 347.
 Almoxarife, Praia do, 327, 329.
 aloe, 39, 44.
 Altares, 302, 310, 311.
 Alva, Duke of, 58.
 Alvaro Rodriguez island, 336.
 Amarelo hill, 261.
 Amarilla, Montaña, 216.
 Ambar, Punta del, 122.
 America, United States of, 98, 103, 105;
 emigration, 281.
 Americas, the, emigration from Azores
 to, 76.
 Ampugenta, 196.
 Anaga, lighthouse, 151; mountains,
 142, 148, 151, 160; peninsula, 144,
 147, 148, 149, 150, 160; population
 of, 151; ridge, 142; roads, 165.
 —, Punta de, 142, 147, 150.
 Anavingo, barranco, 146.
 Angostura, barranco de, 127.
 Angra do Heroísmo, 70, 76, 302, 303,
 304; cables, 110; cathedral, 303;
 communications, 310; description,
 307-10; fish cannery, 307; history,
 309; hospital, 82; industry, 309;
 population, 268, 305; port, 7, 307-10;
 radio, 350; roads, 311; telephone,
 109; trade, 103; typhoid, 81; wire-
 less, 350; winds, 29.
 — — —, Baía de, 304, 307, 308.
 — — —, district, 80.
 Angustias, las, barranco, 19, 177, 179,
 181, 186.
 Anjos, 270.
 Antigua, 196, 198, 199, 200, 203.
 António, D., Prior of Crato, 70.
 apple, 42, 130, 236, 287.
 —, custard, 101, 130, 236.
 apricot, 130, 236, 287, 323.
 aquifer, 14, 196.
Arabis albida, 45.
 Arafo, 143, 145, 146; population, 154,
 155.
 araucaria, 44, 277, 278.
 arbutus, 44.
 Areia Larga, 110.
 Arenas, Montaña de las, 142.
 —, Negras, 166, 167.
 Arfet, Anna d', 61.
 Argaga bay, 171.
 Argentina, 98.
 Argual, 179, 182, 184.
 Arguineguin, 118, 119, 123, 128; roads,
 139, 141.
 —, barranco de, 117.
 Ariciro (Fayal), 333.
 Arico, 86, 154, 155, 166.
 —, El Lomo de, 155, 166.
 —, Nuevo, 155.

- Arico, Viejo, 148, 155, 166.
 Arieiro, Pico do, 224, 253.
 Arinaga, 122.
 —, bay of, 122.
 —, Montaña de, 122.
 —, Punta de, 122.
 Arnel, Ponta do, 279.
 Arona, 156.
 Arrecife, Puerto de, 78, 207, 208, 209, 210, 212; administration, 79; cables, 107, 202; communications, 214; description, 212-14.
 —, de la Raya, 212.
 — Quebrado, 213.
 Arrieta, 215.
 —, bay of, 209.
 Arrochela, 325, 333.
 arrowroot, 130.
 Artenara, 129, 139.
 Arucas, 118, 119; population, 125; roads, 140.
 —, Montaña do, 125.
 Asclepiad, 44.
 Asientos, Los, 157.
 Aske, Captain Thomas, 8.
 Ataide, Luiz Gonçalves de, 62.
 Atalaia, Pico de (Burt peak), 265.
 Atalaya, La (Gran Canaria), 92, 127, 147.
 —, Montaña (Lanzarote), 207.
 —, — la (Fuerteventura), 193, 199.
atarjeas, 179.
 Atlantis, 52, 54, 84.
 azalea, 41.
 Azofa, Fuente de, 187.
 Azores, the, 7, 10; administration, 79-80; area, 6, 267; caves, 20; climate, 6, 24; cloudiness, 33; commerce, 97, 103-5; currents, 24-5. description, 267-338; discovery, 66; exports, 7, 103-4; fauna, 47-51; flora, 39; gales, 28; history, 66-77; imports, 103; insects, 50; meteorological statistics, 345; molluscs, 51; people, 94-6; population, 6, 267; position, 4; pressure, 26; radio, 349; rainfall, 35; relief, 6; seismic activity, 340-2; settlement, 68; shipping lines, 104-5; signal communications, 109-11; swell, 38; temperature, 30-2; trade, 103-5; visibility, 37; volcanic activity, 22, 340-2; winds, 27; wireless, 111, 349.
 Azul, Lagoa, 275, 276.
 Badajoz, barranco de, 155.
 Bagacina, Pico da, volcanic activity, 340.
 Baixo, Ilhéu, de (Porto Santo), 14, 255, 258, 259.
 —, Porto do, 322.
 — Grande, Ponta do, 321, 322.
 — Raza, islet (Flores), 72, 334.
 Bajamar, 165, 166; cables, 107.
 —, Playa de, 181, 185.
 balo, 39, 43.
 bamboo, 46, 130.
 Bañaderos, 123, 125.
 banana, in Azores, 42, 287.
 —, in Canaries, 7, 44, 60, 99, 120, 125, 126, 127, 128, 130, 132, 136, 140, 153, 154, 158, 163, 169, 171, 172, 173, 182, 184, 185, 200, 347.
 —, in Madeira, 7, 42, 101, 236, 240, 243, 287.
 Bandama, Caldera de, 117, 127, 133.
 Bandeiras, volcanic activity, 341.
baracouta, 242.
 barbusano, 47.
 barley, in Azores, 42, 286, 287, 314.
 —, in Canaries, 158, 173, 184, 201, 211.
 —, in Madeira, 42, 238, 259.
 Barlovento, 183, 186.
 Barreto, Duarte, 68.
 Barranco Hondo, Punta de, 149, 150.
 Barrosa, 275.
 Basques, the, 84.
 bat, 48.
 Bazán, Admiral de, 71, 72, 75.
 beans, 7, 152, 184, 236, 287, 293, 306.
 —, broad, 44, 286.
 —, french, 240.
 —, haricot, 240.
 Becerro, Punta del, 171.
 Behaim, Martin, 69.
bemfeitoria, 237.
 Bencomo, 58.
 Bentaguaya, Roque de (caves), 20.
 Berbers, 84.
 Berge, Josua van der, 68.
 Bertendona, General Martin de, 74.
 Bermeja, Montaña (Graciosa, Canaries), 216.
 —, — (Tenerife), 167.
 Betancuria, 193, 196, 198, 199, 203.
 Bethencourt, Jean de, 55, 83, 85, 199.
 —, Maciot de, 56.
 bignonia, 41.
 bilberry, 42, 227.
 Bilma, Montaña, 21.
 Biscoitos, Ponta, 304.
 Biscoutos, 302, 305, 311.
 Blake, Admiral, 59, 160.
 blue fish, 242.
 Boaventura, 233.
 Boa Vista (Flores), 336.
 Bocaina, Estrecho de, 198, 209.
 bonito, 134, 289, 328.
 Bontier, Pierre, 83.
 Boqueirão Norte, 261.
 bougainvillea, 41.
 Bragança, Catharine of, 64.
 —, Duke of, 69.
 Branca headland, 313.
 Branco, Pico, 257.
 Brava, Ribeira, stream, 223, 225, 227, 232.

- Brazil, 69, 238; emigrants to, 63, 75, 270, 281; loss of, 65.
 —, Monte, 304, 307, 308, 310.
 Breña Alta (La Palma), 182, 186.
 — Baja (—), 177, 179, 182, 186.
 —, la (Lanzarote), 207, 210.
 —, — (La Palma), 180.
 —, Montaña de la, 182.
 Bretanha, 68, 280, 285.
 Brezos, Montaña del, 129.
 Britain, Great, 8, 98, 99, 103, 104; alliance with Portugal, 8; exports to, 132; relations with Atlantic islands, 7; relations with Madeira, 64-5; trade with, 60.
 Bual, wine, 239.
 Buenavista (La Palma), 182, 186.
 — (Tenerife), 20, 144, 146, 149, 152, 154; roads, 165.
 —, Monte (La Palma), 185.
 Bufadero, barranco del, 148, 151.
 —, Valle del, 59, 151.
 Bugio, island, 222; description, 261.
 Bulqueime, 254.
 Bulkeley, Captain, 248.
 bull-baiting, 95, 306, 309.
 bullfinch, grey, 48.
 Burt peak (Pico de Atalaia), 265.
 bustard, 49.
 Bute, Marquess of, 87.
 buzzard, 48, 67.

 Caballo, Puerto, 148.
cabildos insulares, 78.
 cables, submarine, 106-7.
 Cabo —, *see under* proper name.
 Caboco, Pico, 334.
 Cabouce, 300.
 Cabral, Velho Gonçalves, 66, 67, 68, 273, 283.
 Cabras, Puerto de, 78, 79, 193, 195, 196, 197, 199, 200, 201; cable, 107, 202, 214; communications, 202-3; description, 201-2; telegraph, 106, 107.
 —, Río de, 196.
 Cabrestante, Ponta do, 271.
 Cabrito, Monte, 180.
 Cadamosto, A. da, 46, 56, 57, 62, 63, 85, 86, 90.
 Cádiz, 58; cables, 106.
 Caes do Pico, 319, 321, 324; telegraph, 110.
 Cagarras, Enseada das, 265.
 Cais, Ponte (Porto Santo), 260.
calado, 130.
caldeira, 18; *see also under* proper name.
 Caldeira, the (Fayal), 332.
 — (Graciosa), 313, 314.
 Caldeiras da Ribeira Grande, 276.
 —, hydro-electric station, 293.
caldera, 17; *see also under* proper name.
 Caldera, Montaña de la, 219.
 Calera, La, 173, 176.
 Cales, Ribiera das, 252.
 Caleta, Punta, 189, 191.
 — del Palo, 203.
 Caletas, Las, 180.
 Calheta (Madeira), 233, 237, 250.
 — —, conçelho, 231.
 — (S. Jorge), 315, 316.
 —, Ponta da (Porto Santo), 255, 257, 258, 260.
 Calhetas, 296.
Calluna vulgaris (ling), 304, 323.
 Caloura, 280, 287.
 Calvario, El, 182.
 Camacha (Madeira), 227, 232, 235, 236; roads, 254.
 — (Porto Santo), population, 258.
 Câmara de Lobos, 62, 230, 232, 234, 250; fishing, 242; jetty, 242; vineyards, 239.
 — — —, conçelho, 231.
 Cámara, Gonçalves de, 56.
 Cambuesa, barranco, 146.
 camel, 174, 197, 200, 201, 202, 212, 214.
 camellia, 41.
 Campanario, 250.
 camphor, 44.
 Campo de Cima, 258.
 Cañadas, Las, 13, 45, 142, 143; cloudiness, 34; crater, 16, 17; drainage, 146, 147; population, 154, 156; rainfall, 36; relative humidity, 32; roads, 163; snowfall, 37; temperature, 31.
 Canaries, the, administration, 78-9; area, 6, 115; climate, 6, 24, 25, 27, 28; cloudiness, 33; commerce, 97-100; description, 115-220; exports, 7, 99, 347; fauna, 47; flora, 39; formation, 15; gales, 28; Guanches in, 83-92; history, 52-60; imports, 97-9, 346; insects, 50; lizards, 49; meteorological table, 343; people, 83-94; physical description, 10; population, 6, 92-4, 115; ports, 7; position, 3; radio, 348; rainfall, 35, 36; sea and swell, 38; shipping lines, 99-100; signal communications, 106-8; telegraph, 106-8; telephone, 106-8; temperature, 30, 32; trade, 346; trade routes, 99; vegetation, 7, 42-4; visibility, 37; volcanic activity, 20; winds, 27; wireless, 348.
 canary chat, 48.
 —, green, 48.
 Canavieira Ponta, 257, 258.
 Candelaria (S. Miguel), 278, 285, 301.
 — (Tenerife), 148, 154.
 Candia, 68.
 Cangueiro, 333.
 Caniçal, 223, 224, 229, 231, 242.
 Caniço, 232; roads, 251, 254.
 —, Pico do, 223.

- canna, 41.
 Canning, George, 8.
 Cañón, 173.
 Cantarinhas, Ponta, 336.
 Cantera (Cala Cantera), 171.
 Cape-gooseberry, 130.
 Capelinhos, lighthouse, 109.
 Capelas (Fayal), 333.
 Capellas (S. Miguel), 275, 278, 284;
 port, 279, 280; roads, 295, 298, 299,
 300, 301; whaling, 290.
 Cape Verde Islands, 3, 25, 67, 108.
capote, 95.
 Carapacho headland, 313.
carapuça, 95, 96.
 Carcavelos (Lisbon), cables, 108, 247.
 Cardón, Montaña del (Fuerteventura),
 194, 196.
 —, Playa del (Gran Canaria), 122.
 Carmona, General, 77.
 Carneiro, Monte, 329.
 carob, 200.
 Carrizal, 118, 119, 127; roads, 141.
carro, 247, 248.
 Carvao, Lagoa, 276.
 Casillas del Angel, 199, 201, 202, 203.
 —, Las, 129.
 Castanheira, Ponta da, 261.
 Castellitos, Ponta dos, 315.
 Castelo Branco, 327, 333.
 — —, Ponta de, 327.
 —, Pico do (Porto Santo), 255, 257.
 castor-oil, 130.
 Castro, D. Fernando de, 56.
 Caxorro, Porto do, 322.
 Cedro, Pico del (La Palma), 180.
 —, — do (Madeira), 224, 253.
 Cedros (Fayal), 109, 327, 333.
 —, Ribeiro dos (Madeira), 237.
 Cenouras, 257.
 Cerda, D. Luis de la, 54.
 Chahorra, Montaña de, 21.
 Chão (Desertas), 222; description, 261.
charco, 118, 120.
 Charles II, King of England, 64.
 Chaves, Montaña de, 142.
cherná, 241.
 chestnut, 40, 42, 44, 46, 121, 130, 131,
 190, 236, 277.
 chick-pea, 201, 202, 211, 240.
 chicory, 104, 293.
 Chilegua, 196, 200.
 Chio, 143, 166.
 Chipude, 87, 173, 174.
 cholera, 81.
 chough, 49.
 Churchill, Winston S., speech on the
 Azores, 8.
 Cima, Fajã da (S. Miguel), 278.
 —, Ilheu de (Porto Santo), 257.
 cistus, 44, 121, 180.
 citron, 42, 130, 184, 236.
Citrullus Colocynthis, 44.
 Clara, Montaña, island, *see under*
 Montaña.
 Clérigo, Ponta do, 228.
 cochineal, 43, 60, 99, 130, 133, 159, 201,
 202, 347.
 —, fig, 188.
 cock-fighting, 95.
 codeso, 45, 159, 180.
 coffee, 44, 130, 182, 236, 288, 346.
 Columbus, Christopher, 9, 21, 58, 67,
 69, 116, 175, 258, 269.
 — —, marriage of, 61.
 Comprida, Ponta, 326, 327.
 Conceição, 326.
 Confital bay (Gran Canaria), 15, 123,
 130, 135, 138; cable, 106, 107.
 —, Playa de (Tenerife), 149.
 Congro, Lagoa, 276.
 Contendas, Ponta das, 304.
 Cook, Captain James, 66.
 Corbizzi, Angiolino de, 54.
 Corchos, Los, 190.
 Corona, Montaña, 205.
 Corralejo, hamlet, 203.
 —, Punta de, 198, 203.
 Corujeira, 225.
 Corvo, island, 6, 329; administration,
 80; area, 267, 337; crater, 17; descrip-
 tion, 337–8; discovery, 67; history,
 71; population, 267, 337; radio, 351;
 settlement, 67; shipping, 104; wire-
 less, 351.
 Coteras, barranco de las, 147.
 courser, cream coloured, 48.
 Cristianos, Puerto de los, 149, 156, 166.
 Cromwell, Oliver, 59.
 Cruces, Islote, 209, 212.
 Cruz de Tejada, 140, 141.
 —, Ponta da (Madeira), 223, 229, 230,
 242; cannery, 241; mole near, 242.
 —, — — (Porto Santo), 257.
 —, Porto da (Madeira), 228, 233, 234,
 238; roads, 249, 252.
 —, Puerto de la (Fuerteventura), 200.
 —, — — (Puerto Orotava, Tenerife),
 30, 31, 142, 149, 153, 160; port, 163;
 roads, 165.
 Cruzinhas, 249, 252.
 Cuesta, La, 166; power station, 165.
 Cueva Bonita, 181.
 — de los Verdes, 18.
 Culcita fern, 278, 279.
 Cumberland, Earl of, 59, 71.
 Cumbre, the (Tenerife), 13, 142, 146,
 148, 149, 151, 154; roads, 165.
 — de Amuerga, 118.
 — del Valle, 165.
 — Nueva (La Palma), 177; pine forests,
 180; roads, 181, 185, 186.
 —, Vieja (La Palma), 177, 179, 180;
 roads, 181, 185.

- Cumbres, the (Gran Canaria), 117, 121, 126, 127, 128; population, 129; vegetation, 119.
 Cumbrecita, La, 179.
 Cume da Praia, Serra do, 302, 303, 312.
 Cumplida, Punta, 181.
 Curral, Grande (Curral das Freiras), 19, 224, 225, 232, 254.
 —, outer, 254.
 cypress, 278.
 Cyprus, 68.

 date palm, 236, 240.
 datura, 41.
 Daute, 154.
 Defiance, the, 72.
 Dehesa, Punta, 187.
 Delgada, Ponta (Madeira), 228, 229, 233.
 Deserta Grande, 22, 222, 261, 262, 263.
 Desertas, the, 4, 62, 222; description, 261-3; lizards, 49.
 Diamante, barranco, 195.
 Dollabarets, Captain P., 273.
 —, the, 273.
 dolphin, 242, 290.
 Doramas, 121.
 dourado, 242.
 Doze Ribeiras, 306, 311.
 Dragon-tree (*Kleinia nerifolia*), 39, 44, 46, 47, 90, 121, 256.
 Drake, Sir Francis, 7, 59, 70, 135.

 Edrisi, 54.
 El —, see *under proper name*.
 Elizabeth, Queen of England, 70.
 elm, 40, 277.
 embate, 29.
 embroidery, 101, 103, 234, 246, 285, 293, 309; in Porto Santo, 258.
 Enchereda, mountains, 172, 176.
 Encumeada pass, 253.
 erica (*Clethra arborea*), 40.
 Erque, barranco, 168.
 escobón, 45, 159.
 Escobonal, El, 147, 166.
 Escuro, Monte, 274.
 espada, 241.
 Espalamaca, Ponta, 325, 326.
 Espartal, Ponta do, 304, 322.
 Esperanza (Tenerife), forest, 167.
 —, Pico da (S. Jorge), 315, 341.
 Espigao, 256.
 Espinosa, A. de, 83, 84, 86, 89, 90, 154.
 Espírito Santo (Porto Santo), 258, 259.
 Este, Roque del, 78, 218.
 Estreito da Calheta, 237.
 — de Câmara de Lobos, 250.
 Estremadura, 269.

 eucalyptus, 40, 42, 44, 46, 277, 278.
 euphorbia, 39, 41, 43, 44, 119, 121, 180, 188, 197, 219, 320.
 —, canariensis, 43.
 Evora, charter of, 69.

 Facho, Pico de (Porto Santo), 255.
 —, Serro do (Graciosa, Azores), 313.
 Faial (Madeira), 228, 234, 237; roads, 247, 252, 253.
 —, Ribeira do, 225, 227.
 Fajã da Ovelha, 233, 237; roads, 251.
 — de Baixo, 299, 300.
 — de Cima, 299, 300.
 — Grande, 336.
 Fajão do Bello, Ponta, 316.
 Fajãzinha, 336.
 Falangist, régime, 78, 79.
 Famara, Playa de, 209.
 —, Risco de, 205, 209, 211.
 Fana, Baia do, 304, 307, 308.
 Fanal (Madeira), 223.
 Farilhão Testa (Sail rock), 261.
 Fariones, Punta, 209, 218.
 Fasnía, 21, 155, 157, 166.
 Fataga, 139, 141.
 —, barranco do, 117, 118, 119, 123, 128, 129, 141.
 faya, 44, 45, 46, 170, 180, 271, 277, 278, 320, 323, 325.
 Fayal (*or* Faial, Azores), 6, 7, 8, 46, 71; administration, 80; agriculture, 328; area, 267, 325; cables, 110, 325; coasts, 326-7; crater, 17; communications, 332-3; description, 325-33; fishing, 328; industries, 328; population, 267, 327-8; ports, 328; radio, 350; rainfall, 35; relief, 325; settlement, 69; signal communications, 110-11; telephones, 109, 110; vegetation, 326; volcanic activity, 341; water-supply, 325-6; wireless, 350.
 — channel, 322, 325, 326.
 — da Terra, 283.
 Femés, 207, 208, 210.
 Fenaes d'Ajuda, 298.
 — da Luz, 284, 299, 300, 301.
 fennel (*funcho*), 243.
 fern, 41.
 —, tree, 42.
 —, *Adiantum reniforme*, 40.
 —, *Woodwardsia radicans*, 40.
 Fernando, Don, 69.
 — Po, 3.
 Ferraria, Ponta da, 280; submarine eruption, 341, 342.
 Ferreira point (Graciosa), 313.
 Ferreiros, Ponta dos, 257.
 Ferro, islet, 257.
 Feteira (Terceira), 311.
 Feteiras (Fayal), 327, 333.
 — (S. Miguel), 278, 301.

- fig, 42, 44, 127, 174, 184, 188, 190, 201, 212, 236, 240, 287, 288, 323.
 Firgas, 119, 120, 125.
 Flamengos, 326, 327, 333, 341.
 —, stream, 329, 331, 333, 341.
 flax, 172.
 — (*Phormium tenax*), 271, 288.
 Flemings, colonization of Azores by, 67, 303, 309.
flor de Canaria, 133.
 Flores island (Azores), 6, 8; administration, 80, 329; area, 267, 334; cloudiness, 33; description, 334-6; discovery, 67; gales, 28; history, 67, 69, 71, 72; population, 267, 336; radio, 351; rainfall, 35; settlement, 69; shipping, 104; volcanic activity, 341; wireless, 351.
 — (La Palma), 179, 182, 186.
 Florida, 196, 201.
 Fogo headland (Graciosa), 313.
 —, Lagoa do (S. Miguel), 17, 275, 276; volcanic activity, 340.
 —, Pico do (Fayal), 325, 341.
 —, — (S. Miguel), 340.
 Fojos, Cabeza de, 315.
 Fonte, Cabeço del, 325, 333.
 — da Areia, islet, 257.
 Fora, islet (Porto Santo), 257.
 —, Ilhéu de (Selvagens), 222, 265.
 —, — — (Madeira), 223, 227, 228, 229.
 Formigas, rocks, 66; description, 273.
 Formoso, headland, 281.
 —, Porto, 279, 281, 283, 290; population, 284; roads, 297, 298.
 Fortaleza, La, 129, 168, 173.
 Forte do Pico (Funchal), 243, 245; radio, 247.
 — island (Graciosa), 313.
 — point (S. Miguel), 281.
 —, Ponta de (Fayal), 328.
 Fortunate Islands, 53, 54, 116.
 Frades, Ponta dos, 270, 271.
 Francés, Islote, 209, 212.
 Francis I of France, 63.
Frankenia, 42.
 Frio, Ribeiro (Madeira), 236, 252.
 Frobisher, Martin, 71.
 Frontera, 190, 192.
 Frutuoso, 62.
 Fuego, Montañas del, 22, 207, 210, 211, 214.
 Fuencaliente, 21, 179, 182, 184, 186.
 —, Punta, 181.
 Fuente Agria, barranco de la, 119.
 — de la Grieta, 147.
 — Nueva, 179.
 — Santa (Gran Canaria), 119.
 — —, La (Gomera), 169.
 Fuerteventura, island, 4, 10, 14; administration, 78; arab skeletons, 84; area, 115; coasts, 197-8; communications, 202-3; description, 193-203; drainage and water-supply, 195-7; fauna, 48; fishing, 134; formation, 12; Guanches, 88; history, 53, 55, 56, 59; industries, 200-1; population, 115, 199-200; ports, 201; rainfall, 36; relief, 193-5; signal communications, 106; vegetation, 197.
fumaroles, 16.
 Funchal, 224, 225; administration, 79; British Colony, 232; cable, 108; cathedral, 243; commerce, 100; communications, 247; description, 242; exports, 102; fishing, 242; history, 66, 243-5; hospital, 82; humidity, 32; industry, 234, 235, 245-6; meteorological table, 344; population, 221; port, 7, 242-7; radio, 349; rainfall, 35; roads, 228, 234, 248, 249, 251, 252; settlement, 62, 64; sheep, 241; shipping, 100; sugar refineries, 238; telephone exchange, 108; vegetation, 227; vineyards, 239; visibility, 37; winds, 29; wireless, 108, 349.
 —, Baia do, 62, 229, 242.
 —, concelho, 231, 232.
 Furada, Ponta (S. Jorge), 316.
 Furado, Levada do, 236.
 —, Ponta do, 223.
Furna do Enxofre, 18, 313.
 Furnas, 274, 276, 277, 278, 279, 280; population, 281, 282, 283; roads, 295, 296, 297, 298; valley, 278, 340; springs, 23.
 —, Lagoa das, 17, 274, 276, 297.
 — Lake Hotel, 298.
 Gáldar, 118, 119, 120, 125, 126; roads, 140.
 —, barranco de, 126.
 —, bay of, 123.
 —, Montaña de, 117, 126.
 —, Pico de, 16.
 Galera, Ponta da, 279, 280.
galertas, 145.
 Galletas, bay of, 149.
 Gama, Paul da, 69, 309.
 —, Vasco da, 69, 309.
 Gando, airport, 108, 122, 141; radio, 348; wireless, 348.
 —, bay of, 54, 57, 122, 127.
 —, Punta de, 121, 122.
 Garachico, 21, 143, 147, 149; cables, 107, 185; destruction in 1706, 18; population, 154; roads, 165; springs, 146.
 Garafía, 183.
 Garajão, Ponta do, 61, 108, 229, 234, 242; radio station, 247, 349; wireless, 349.
 Garajonay, mountain, 168, 173, 176.
 —, Alto, 168.
 Garca, Ponta da, 282, 297.

- Garcia, 145.
 Gata, Montaña de, 144.
 geranium, 41.
 Germany, 104; export of pine-apples to, 287.
 Gibraltar, 110.
 Ginetes, 301.
 Ginjal, hill, 303.
 Girão, Cabo, 230.
 Goa, 68.
 gofio, 89, 92, 93.
 Goime, 207.
 Goleta, La, 125.
 Golfo, El, 187, 188, 189, 190, 192.
 Gomera, island, 4, 45; administration, 78; agriculture, 157; area, 115; coasts, 171-2; communications, 175-6; description, 168-76; drainage and water-supply, 169; fauna, 49; formation, 12; history, 55, 56, 57, 58, 59; industries, 173-4; population, 172-3; ports, 174; relief, 168; signal communications, 106, 107; vegetation, 169-71; volcanic evidence, 16.
 Gomes, Ribeira de João, 243.
 Gomez bay, 313.
 Gorda, Punta (Fuerteventura), 197, 198.
 —, — (Gran Canaria), 123.
 —, — (La Palma), 181, 197, 198.
 —, Serra (Pico), 324.
 —, — (S. Miguel), 275, 300.
 Gordejuela, water-works, 146.
 Gordo, Pico, volcanic activity, 340.
 Goteras, barranco de las, 127.
 gourd, 130.
 Graciosa (Azores), island, 6; administration, 80; area, 267, 313; description, 313-14; history, 71, 72; lava-flows, 22; population, 267, 313; radio, 350; settlement, 68; volcanic evidence, 23; wireless, 350.
 — (Canaries), island, administration, 78; description, 216-17; fishing, 134; lava-cliffs, 20.
 Gralhos, 61.
 Grammas, 277.
 Gran Caldera de Tabouriente, 17, 177; drainage, 179; forests, 180; population, 181, 182; roads, 185, 186.
 — Canaria (Grand Canary), 47, 193; administration, 78; agriculture, 130-3; area, 115; coasts, 121-4; communications, 139-41; description, 117-41; distribution of population, 124-9; drainage and water-supply, 118-19; fauna, 48; fishing, 134; flora, 41; forests, 47; history, 56, 57, 59; industries, 130; livestock, 133; ports, 134; radio, 348; relief, 117; signal communications, 106, 107; snowfall, 37; vegetation, 119-21; vulcanism, 16; wireless, 348.
 Gran Tarajal, 193, 197, 198, 200, 201, 203; roads, 202.
 — —, barranco de, 195, 198, 203.
 Granadilla, 79, 149, 156, 166.
 Grande, Caldeira, 276, 277.
 —, Lagoa, 275, 276.
 —, Pico, 224.
 Granel, El, 183.
 Granga, Cabeza da, 318.
 Grenville, Sir Richard, 7, 71, 74, 75.
 Griñon, telephone, 106.
 ground-shark, 242.
 Guadalupe, 314.
 Guajara, 143; pass, 147.
 Guanarteme, isthmus, 134, 135.
 Guancha, La, 146, 153.
 Guanches, the, 18, 20, 151, 154; characteristics, 85; customs, 92, 127; government, 91-2; language, 86-7; mode of life, 87-9; origin, 83; religion, 89-90.
 Guatiza, 211, 215.
 guava, 120, 130, 240.
 Guayadaque, barranco de, 118, 122.
 Guayera, 129.
 Guaza, Montaña de, 149.
 Guia (Gran Canaria), 79, 126; fish cannery, 134; population, 155; roads, 140.
 — de Isora (Tenerife), 147, 166.
 —, Monte da (Fayal), 109, 326, 329.
 Guilherme Moniz, Caldeira de, 302, 303, 308.
 Güimar, 13, 18, 20, 21, 44, 87, 142, 148, 163; cloudiness, 35; depression, 143, 146; population, 155; rainfall, 36; roads, 148, 166; temperature, 31.
 —, Ladera de, 143, 155, 166.
 —, Punta de, 148.
 —, Volcan de, 147, 148, 155.
 Guiniguada, barranco de, 125, 126, 127, 135, 136.
 — —, roads, 140.
 Guinea, Spanish, 79.
 Hacha Grande, Montaña, 207.
 Haegen, William van der, 68, 69.
 hake, 134, 159.
 Hanno, 53.
 Haría, 18, 205, 208, 209, 210, 211, 212; roads, 214, 215.
harmattan, 26.
 Havana, 72.
 Hawkins, Sir John, 7, 59, 71.
 heath, 42, 46, 278.
 —, tree-, 44, 45, 180, 277, 278, 279, 323.
 heather, 180, 227.
 Heineken's black cap, 48.
 Henry, Prince, the Navigator of Portugal, 56, 61, 62, 63, 66, 67, 68, 69.
 — III of Castile, 55.
 hepatica, 41.

- Hercules, 53.
 Hermigua, 172, 174; roads, 175.
 —, barranco de, 168, 169, 170, 172, 176.
 — Alta, 169.
 Herques, barranco de, 147, 166.
 Herrera, Diego de, 57.
 Hesperides, garden of, 53, 153.
 hibiscus, 41.
 Hidalgo, Punta, 144, 150, 166.
 Hierro (Canaries), 4, 89; administration, 78; area, 115; agriculture, 157; coasts, 188-9; communications, 191-2; description, 187-92; drainage and water-supply, 187-8; history, 53, 55, 56; industries, 190-1; initial meridian, 53; lizards, 49; population, 189-90; ports, 191; relief, 187; roads, 191-2; signal communications, 106, 107; vegetation, 188.
 —, Puerto del, 175, 189, 191, 192; cables, 107.
 Hila, Puerto de la, 175.
 holly, 44.
 —, Canarian, 170.
 —, small leaved, 44.
 Homer, 53.
 Hondo, barranco, 149, 150, 153, 165.
 Hormigon (Formigão), 273.
 horse-mackerel, 289.
 Horta, 7, 8, 76, 295, 322, 323, 324, 325; beach, 326; cables, 110, 268, 310; caves, 20; cloudiness, 33; communications, 332-3; description, 329-32; history, 329-31; hospital, 82; industry, 331; population, 268, 327; port facilities, 332; radio, 350; rainfall, 35; trade, 103; volcanic activity, 341; water-supply, 326; wireless, 350.
 —, Baía de, 326, 331.
 —, district of, 80.
 Houbara bustard, 48.
 Howard, Lord Thomas, 71, 72, 74.
 Hoya, La, 150.
 —, —, bay, 150.
 — Grande, 147.
 Huecos, galería de los, 146.
 Huerter, Jobst van, Lord of Moerkerke, 69, 329.
 Humboldt, A. von, 153.
 — corner, water-tanks, 146.
 hydrangea, 41, 278, 326, 334.
 Icod de los Vinos, 18, 47, 79, 84, 143, 144, 149; population, 150, 152, 153, 154; roads, 163, 164, 165.
 Icor, 147.
 Idafe, 90.
 Iglesia de la Concepción, 152.
 Igueste, 151, 165.
 Ilha, Ponta da, 321, 322.
 Ilheos, Ponta dos, 334.
 Inferno, Caldeira (Fayal), 326.
 Infierno, barranco del (Tenerife), 147, 156.
 Ingenio, 127, 128.
 Isabella, grape, 323.
 — of Burgundy, 69.
 Isleta, La, 117, 121, 124, 134, 136.
 Izana, Montaña de, 156, 167.
 Jandía, isthmus, 198.
 —, mountains, 195.
 —, peninsula, 195, 199, 200, 203.
 Janela, 225.
 —, Ribeira da, 225, 233, 237.
 Janubio, Lago de, 207, 208, 209, 210.
 Jennings, Admiral, 59.
 Jinamar, 15, 122, 141, 191, 192.
 John-dory, 241.
 Juan Grande, 118, 119, 128; roads, 141.
 — Mayor, barranco de, 186.
 Juba, King of Mauritania, 53.
 Juby, Cape, 4, 10, 193.
 Judeu, Porto, 306.
 Juliana, Pico, 257.
 Juncal, Levada do, 236.
 juniper (*Juniperus Oxycedrus* or *cedro*), 40, 46, 277, 278, 303, 315, 320, 321.
 Junot, General, 65.
 Junta Geral, 80.
 Jurada, Punta, 197, 198.
 —, quarries, 148, 156, 163, 164.
 kestrel, 48.
 Kidd, Captain, 266.
 Kite, 49.
 La —, *see under proper name*.
 La Luz, Puerto de, 117, 118, 121, 123, 124; description, 134-9.
 La Palma (Canaries), 4, 17; administration, 78; agriculture, 157; area, 115; coasts, 181; communications, 185-6; description, 177-86; drainage and water-supply, 179-80; fauna, 49; forests, 47; formation, 12, 13, 14; history, 56, 57, 58, 59; industries, 183-4; population, 115, 181-3; ports, 184-5; relief, 177-9; vegetation, 180; volcanic activity, 20; signal communications, 106, 107.
 Lagens (Flores), 334, 336; radio, 351; wireless, 351.
 —, bay of, 334.
 —, Ponta das, 334, 336.
 — (Pico), 109, 110, 322, 324; lava-flow, 341.
 — (Terceira), 302, 311.
 Lagido point, 322.
 Lagoa (S. Miguel), 275, 277, 279, 281, 282; harbour, 280; pine-apple, 287; population, 284; roads, 295, 296, 298, 299, 300; terra-cotta works, 285.

- Lagoa (S. Miguel) bay, 290.
 —, Forte de (Fayal), 110.
 Laguna, La (Gomera), 168, 176.
 —, — (Tenerife), 16, 108, 142, 148;
 bishopric, 79, 152; communications,
 163, 165, 167; forests, 47; population,
 150, 151, 152; radio, 349; telegraph,
 106; temperature, 31; wireless, 349.
 —, —, plateau, 44, 144, 158, 160.
 Lagunetas, Las, 140.
 Laja, La, 122, 141.
 Lajas, Puerto de, 196, 198.
 Lamaceiro pass, 236.
 Lameiro, 297.
 land-tenure, Azores, 286; Canaries, 131;
 Madeira, 237.
 Langrero, 168.
 Lanzarote, island, 4; administration, 78;
 arab skeletons, 84; area, 115, 205;
 coasts, 209; description, 205-15;
 drainage and water-supply, 207-8;
 fishing, 134; Gaunches, 88; history,
 53, 55, 56, 59; industries, 211-12;
 lizards, 49; population, 210-11; ports,
 212; rainfall, 36; relief, 205-7; sand
 dunes, 15; signal communications,
 106, 107; vegetation, 208; volcanic
 activity, 20.
 Lapa, Ribeira da, 254.
 Lapas, Las, 190.
 Las Palmas (Gran Canaria), city, 7, 78,
 121; bishopric, 79; cables, submarine,
 106, 107; cloudiness, 34; history, 135;
 hospital, 82; industry, 135-6; popula-
 tion, 124, 125, 126, 127; port, 134-9;
 radio, 348; rainfall, 36; roads, 122,
 139, 141; water-supply, 118, 119;
 wireless station, 108, 348.
 — — — —, province, 78, 79, 131, 134;
 fishing, 134; livestock, 134.
 laurel, 46, 121, 126, 180, 277.
 —, bay, 42, 46, 227.
 — (*Daphne Gnidium*), 40.
 — (*Laurus canariensis*), 39, 44, 45, 277,
 320, 323.
 Lavanda, 21.
 lemon, 42, 44, 130, 133, 158, 174, 240,
 287, 306.
 lentil, 200, 240.
 Leste, Baixa de, 265.
 levadas, 63, 65, 226, 236.
 lichen, 41.
 lily, arum, 41.
 lily-of-the-valley tree, 46.
 Linschoten, van, J. H., 69, 71, 303, 306,
 316.
 Lisbon, 4, 7, 102, 103, 104, 108, 295,
 316, 324, 332; trade with Azores,
 104.
 Livramento, 296, 298, 299.
 Llano, El (Alegranza), reservoir, 219.
 — de los Viejos, 144.
 Llanos, Los (La Palma), 79, 179, 184;
 population, 182, 183; roads, 186.
 —, —, barranco de, 177, 182, 186.
 Llanillos, Los, 190.
 Llanito de la Barrera, El, 179.
 Lobos, Isla de, 78, 88, 198; description,
 203-4.
 Lombada Vaca, 334.
 Lombadas, 276.
 Lomo Gordo, 141.
 — Jinamar, 122, 127.
 — Listón, 127.
 Loo rock, 243, 245.
 loquat, 120, 240.
 —, Japanese, 130.
 losas, 156.
 Lucta, Terreiro da, 248.
 Lugo, Fernando de, 57, 58.
 lupine, 44, 152, 240, 287.
 Luz, Puerto de la, roads, 139; port,
 134-9; *see also under* Las Palmas.
 Machico, 62, 63, 224, 226, 229, 232;
 fishing, 242; roads, 247, 248, 251, 253,
 254.
 —, bay, 61, 66, 229, 242.
 —, conçelho, 231.
 —, Ribeira de, 225, 232.
 Machin, Robert à, 60, 61, 232.
 Mackay, Major-General Hugh, 65.
 mackerel, 328.
 Madeira, 4, 6, 7, 8, 24, 27, 332; admini-
 stration, 79; agriculture, 235-40; area,
 6, 221; cables, 66, 108; cloudiness,
 33; coasts, 227-30; commerce, 97,
 100-2; communications, 247-54; cur-
 rents, 24, 25; description, 223-54;
 drainage, 225-6; exports, 101; fauna,
 47-51; fishing, 241-2; flora, 39-42;
 formation, 14, 15; gales, 28; history,
 60-6; industries, 234-5; imports, 100-
 1; land-tenure, 237; livestock, 240-1;
 meteorological tables, 344; people,
 94-6; population, 6, 230-4; ports,
 242-7; radio, 349; railway, 248; rain-
 fall, 35, 36; relations with Great
 Britain, 64-5; relief, 223-5; roads,
 248-54; shipping lines, 102; signal
 communications, 108-9; settlement,
 62-4; swell, 38; temperature, 30;
 trade, 102; vegetation, 226-7; visi-
 bility, 38; vulcanism, 22; water-
 supply 225-6; winds, 27; wines,
 export of, 65, 101; wireless, 349.
 Madre del Agua, 146.
 Madres, barranco do las, 119.
 —, galería de las, 145, 146.
 Madrid, telephones, 106.
 madroña (*Arbutus canariensis*), 45.
 Madalena do Mar, 230, 233, 250.
 Magdalena (Pico), 319, 322, 324; radio,
 350; telegraph, 110; wireless, 350.

- Magdalena (Pico) bay, 324.
mahogany, Madeira (*vinatico*), 39, 42, 47.
Maia, 271, 272, 281, 284; roads, 296, 297, 298; tea, 285, 288.
maize, in Azores, 7, 42, 272, 285, 286, 287, 306, 314, 337.
—, in Canaries, 44, 152, 153, 154, 158, 173, 184, 200, 201, 211, 212.
—, in Madeira, 42, 238, 259.
Majona, Punta, 171.
Mal Paso, Alto de, 187, 188, 189.
Málaga, 106.
Malavesi (Crete), 239.
Malmerendo, Ponta de, 271.
Malmsey, 239.
Malocello, Lanzarote, 54.
Malvoisie grape, 63.
mancomunidad, 78, 79.
mango, 44, 120, 130, 236, 240.
mantas, 183.
Manuel I, King of Portugal, 63.
Marechal, Baia do, 261.
Maria II, Queen of Portugal, 76, 80, 309.
Martianez, 150.
Martino, Punta, 204.
Marvão, Ponta, 271.
Mary Sparke, the, 71.
Masca, headland, 149.
Maspalomas, 118, 119, 128; roads, 141.
—, Punta de, 122.
Matanza hills (Gomera), 174.
— de Acentejo, Tenerife, 152, 153.
Matas Blancas, Las, 15, 195.
Mathias Simão, 305.
Matilla, La, 203.
Mazo, 182, 184, 186.
Médana bay, 149, 156, 166.
Médano, Puerto de El, drinking water, 147.
medlar (Japanese), 42, 44.
Meio, 257.
Melenara bay, 127.
—, Punta, 122.
melon, 130, 211, 236, 259.
Mercedes, forest, 151; hills, 47.
—, barranco de las, 165.
Merenda point, 307.
Mesembryanthemum, 42.
Metade, Ribeira da, 236, 252.
Mexico, 59.
Miguel, Dom, 66, 76, 80.
Milán, 150.
millet, 272.
Miraflores, 180, 182.
Misterio, Ponta do, lava-flow, 341.
Mocanal, 192.
Mogador, 25.
Mogán, Puerto de, 123, 128; roads, 139.
—, barranco de, 128.
Mojon, El (Lanzarote), 211.
Mojon, Montaña del (Graciosa, Canaries), 216.
Mole, Ilhéu, 228, 229.
Moniz, Porto, 223, 226, 233, 242, 251; roads, 249; vineyards, 239.
—, —, concelho, 231.
Montaña Clara, island, 20, 78, 134; description, 218.
— Grande, 143.
Montañeto, 16, 150.
Monte Verde (Gran Canaria), 119, 120, 127, 133; roads, 139, 140, 141.
— — (Tenerife), vegetation zone, 44-5, 47.
montera, 93.
Montluc, Pierre de, 64.
Moors, the, 58, 59, 70, 210.
Morales, Juan de, 61.
Morro de la Vieja, 117.
— Grande (Flores), 334, 336.
— — (S. Jorge), 316.
— — (S. Miguel), 281.
moss, 41, 45.
— orchilla, 53, 54, 56.
Mosso, Monte, 329.
Mosteiros (S. Miguel), 20, 280, 285; roads, 295, 298, 301.
'Mount Church' (Nossa Senhora do Monte), 225, 248.
Mount railway, 248.
—, the (Madeira), 252.
Moya, 125.
Mozaga, 214.
Muda, Montaña de la, 193, 203.
Mudo, Punta del, 181.
mulberry, 130, 188, 211, 212, 236.
Muley, barranco de, 195.
mullet, 241.
myrsine, 277, 278.
Naos, Puerto de, 21, 184, 189, 191, 192, 209, 212; communications, 214; description, 212-14.
Negra, Ponta (Fayal), 326, 327.
Negro, Pico (Graciosa), 313.
Nelson, Admiral Horatio, 8; in Tenerife, 59; loss of arm, 160.
Nesquim, Calheta do, 322.
Newfoundland, 4, 10, 110.
New York, 104, 105.
Nido, El, 124, 136.
Nieves, Las (Gomera), 168, 169, 173.
—, — (La Palma), 182.
—, Puerto de las (Gran Canaria), 123, 125, 126.
Niña, the, 269.
Nordestinho, 283, 298.
Nordeste, 283, 284, 295; roads, 296, 297, 298.
—, concelho, 283.
—, Ponta de (Porto Santo), 257.
Norte, Cabeço do (Fayal), 325, 333.

- Norte, Ponta do (Corvo), 337.
 —, Praia do, 328, 333.
 —, Prainha do, lava-flow, 341.
 Nossa Senhora da Guia, 309.
 — — do Pilar, 306.
 — — do Luz, 314.
- oak, 40, 42, 277.
 —, cork, 44.
 oat, 42, 154.
 Oeste, Roque del, 78; description, 218.
Oidium Tuckeri, 239, 287.
 Ojo, Punta del, 122.
 Olho do Cão, 72.
 olive, 130.
 Oliva, 193, 196, 198, 199, 200, 201, 202;
 roads, 202, 203.
 —, Montaña de, 199.
 onion, 7, 133, 136, 155, 184, 200, 201,
 211, 214, 236, 240, 347.
 Oporto, 76.
 opuntia (cochineal cactus), 119, 201.
 orange, in Azores, 42, 68, 103, 104, 282,
 287, 293, 306.
 —, in Canaries, 44, 120, 126, 127, 130,
 133, 154, 158, 174, 182, 184, 200.
 —, in Madeira, 42, 236, 240.
 orchilla, 44, 45, 53, 54, 56, 263.
 Orejas de Asno, 195.
 Organos, Punta de los, 171.
 Orotava, Puerto, *see under* Cruz, Puerto
 de la.
 —, Valle de, 13, 20, 153, 158, 160, 163;
 population, 155.
 —, Villa, 47, 91, 142, 146, 150, 163;
 administration, 79; *fumaroles*, 16; his-
 tory, 58; lowland, 142, 143; meteoro-
 logical tables, 343; population, 150,
 151, 152, 153, 156; roads, 163, 164,
 165, 166, 167; relative humidity, 32;
 water tanks, 146.
 Orsula, Montaña, 205.
 Ortega, Valle de, 196.
 osier, 42, 240, 331.
 Osorios, Los, 119, 121.
 oystercatcher, black, 217.
- Pajara, 198, 199, 200, 201, 203.
 Palheiro (Madeira), 254.
 Palheiros, rocks (Selvagens), 264.
 palm, 40, 44, 212.
 —, Canary, 44.
 —, coco-nut, 44.
 —, date, 44, 130, 169, 174, 200.
 —, royal, 44.
 Palma, La, island in Canaries, *see under*
 La.
 Palmas, Las (Gran Canaria), *see under*
 Las.
 Palo, Punta del, 122, 141.
 Pan-American Airways, 329, 332.
 Papagayo (S. Maria), headland, 271.
- Papagayo, Punta de (Lanzarote), 203,
 209.
 papoya, 130.
 Pared, Ismo de la, 194, 195, 198.
 —, Puerta, 198.
 Paredes, 168.
 Pargo, Ponta do (Madeira), 223, 226,
 229, 230, 233, 247, 248, 249, 251.
 Pargos, Ponta dos (Deserta Grande), 261.
 partridge, 171.
 —, red-legged, 48, 49.
 Paso, El, 179, 182, 183, 184, 186.
 — Alto, 148.
 — del Herrero, 123.
 Patalogos, Cabeza de, 315, 316.
 Patronato, barranco de, 153.
 Paul da Serra, 224, 225, 227.
 — do Mar, 230, 233, 242.
 Pau Pique, Lagoa, 301.
 Paz, La, 146.
 peach, 42, 120, 127, 130, 236, 287.
 Peak of Tenerife, *see under* Pico de
 Teide.
 —, the, *see* Pico de Teide.
 pear, 42, 190, 236, 287.
 —, alligator, 130.
 —, avocado, 101, 236.
 —, prickly, 40, 43, 130, 152, 230, 236.
 Pechiguera, Punta, 209.
 Pedra Rachada, 257.
 — Rosa, Puerto de la, 172.
 Pedregal, Ponta dos (Porto Santo), 261.
 Pedro Botelho, Caldeira de (S. Miguel),
 276.
 — — (Graciosa), 313.
 —, Emperor of Brazil, 66, 76, 80.
 — Gil, pass, 155, 167.
 — Miguel, 333.
 Peña, Puerto de la, 20, 198, 200, 201.
 Penedo, Punta de, 209.
 Penitente, mole, 163.
 Peñon, 172, 174, 176; cable transporter,
 176.
 Penteado, 62.
 Perdoma, La, 146.
 Perestrello, Bartholomeu, Governor of
 Porto Santo, 61, 258.
pepinella, 240.
 pepper, 44.
pescantes, 171, 174.
 Pesqueiro, Ponta do, 337.
 petrel, 48, 218.
 —, Bulwer's, 49.
 —, frigate, 49.
 —, Madeiran, 49.
 Phelps, Mrs., 234.
 Philip II, of Spain, 70, 306.
 — V, of Spain, 59.
 Phoenicians, the, 53, 67, 83.
 phylloxera, 239.
 Pica da Pedra, 278, 298, 299, 300.
 Pico, island (Azores), 6, 16, 277, 315;

- area, 267, 317; climate, 26; coasts, 321-2; communications, 324; description, 317-24; drainage, 318-19; formation, 13; industries, 322-4; population, 267, 322; ports, 324; radio, 350; rainfall, 35; relief, 317-18; settlement, 69; telephone, 109, 110; vegetation, 320-1; volcanic activity, 341; wireless, 350.
- Pico, O, mountain, 6, 317, 318, 319, 320, 321, 322, 323, 341.
- Alto (S. Maria), 270, 272.
- (Terceira), 302.
- de Viento, 140.
- de la Cruz (La Palma), 177, 180.
- de los Pechos, 117.
- de Teide (Peak of Tenerife), 13, 16, 32, 53, 90, 143, 149; climate, 26; cloudiness, 34; flora, 45; population, 150, 152, 153, 155, 156; roads, 164, 165, 166; snowfall, 37; volcanic activity, 21; winds, 29.
- Gorda, 325, 333.
- Grande, roads, 300.
- 'Pico Madeira', 323.
- Pico Verde, 297.
- —, Punta de, 172.
- Piedade, 109.
- Piedra Rosa, Puerto de la, 169, 172, 174.
- pilchards, 104.
- Pilón, 16.
- Pim, Baía de, 326, 332.
- Porto, 327, 332, 333.
- Pinar, the (Gran Canaria), 121.
- (Hierro), 189, 190, 191, 192.
- pine, 40, 42, 277.
- , Canary, 39, 45, 47, 121, 180, 185.
- , cluster, 40, 46, 226, 240.
- forest, 47, 119, 180, 257, 277.
- (*P. maritimus*), 278.
- pine-apple, in Azores, 7, 103, 104, 282, 285, 287, 290, 293.
- , in Madeira, 236, 240.
- pistas*, 164, 166.
- Piton, Great, 264.
- , Little, 264.
- Planalto dos Graminhaes, 274.
- Plato, 52, 84.
- Playa del Inglés, 171.
- Playas, Las, 189.
- Pliny, 53.
- plum, 236.
- plumbago, 41.
- Plutarch, 53.
- poinsettia, 41.
- Poiso, 252, 253, 254.
- Polvo, barranco de, 118.
- Polytrichum* moss, 278, 304.
- Pombal, 75.
- pomegranate, 42, 120, 130, 200, 236.
- Ponta Delgada (Flores), 334.
- — (Madeira), roads, 253.
- Ponta Delgada (S. Miguel), 7, 68, 275, 286, 330; administration, 80; cables, 110, 111; coasts, 280, 281; cloudiness, 33; commerce, 293; communications, 295; description, 290-6; drinking-water, 276; fishing, 289; history, 68, 291-3; hospital, 82; industry, 285, 293; naval base, 8, 76; pine-apples, 287; population, 268, 281, 282, 284; port facilities, 294; prison, 299; radio, 349, 350; rainfall, 35; relative humidity, 32; roads, 296, 298, 299, 300, 301; meteorological tables, 345; telephone, 109, 110; temperature, 30; trade, 103, 293; visibility, 37; winds, 28, 29; wireless, 349, 350.
- Pontinha, Baía da, 246.
- , peninsula, 230, 243.
- , Ponta da, 281.
- poplar, 40, 126, 277, 278.
- Portela, 249, 251, 252, 253, 254.
- Porthcurnow (Cornwall), cables, 108, 247.
- Portillo, El, 143, 147, 163, 167.
- , —, pass, 164.
- Porto Novo (Madeira), 229, 251.
- — (Terceira), 304.
- Pim, 110.
- Santo, island, 4, 221; administration, 79; area, 255; coasts, 257-8; colonists, 61; communications, 259-60; description, 255-60; history, 61; industries, 258-9; livestock, 240; molluscs, 51; population, 258; port, 259-60; radio, 349; relief, 255; settlement, 62; signal communications, 108; vegetation, 256-7; water-supply, 255-7; wireless, 349.
- —, Bahia de, 257.
- Portugal, 6, 65, 67, 98, 103, 104, 272; abolition of slavery, 238; alliance with Great Britain, 8.
- potato, in Azores, 272, 286, 293.
- , in Canaries, 7, 44, 60, 99, 132, 136, 156, 173, 189, 200, 201, 211, 346, 347.
- , in Madeira, 7, 101, 236, 240.
- , sweet, 130, 233, 236, 240, 241, 285, 286.
- Povoação, 68, 277, 279; history, 283; population, 282, 283; roads, 295, 296, 297; volcanic activity, 340.
- Pozuelo de Rey, telephone, 106.
- pozzolana*, 272.
- Praia, Baía de, 303, 304, 307, 327.
- da Victoria, 76, 302, 303, 304, 305, 306, 307, 310, 311; roads, 311; volcanic activity, 340.
- do Norte, Baía da, 327.
- Formosa, 230, 249.
- Prainha, 110, 271, 319.
- Praya (Graciosa, Azores), 111, 313, 314.
- , islet, 313.

- Prazeres, 237, 238, 241, 251.
 Príncipe, 3.
 Ptolemy, 53, 54.
 Pueto, Punta, 209.
 puffin, 48.
 pumice, 156.
 Puntallana, 183, 186.
 Pyramida, Ponta da, 280.

 quail, 48, 49.
 Quartos hill, 261.
 Quatro Ribeiras, 306, 311.
 Queimada, Monte, 326, 329, 331.
 Queimadas, 236.
 Queimado, Ponta do, submarine eruption, 342.
 Quenturas, 277.
 quince, 184, 236.
quintas, 232.

 Rabaçal, 225, 226, 237, 250.
 Rabo de Peixe, 277, 279, 280, 281, 290, 299, 300, 301; population, 282, 284.
 Rada Sardina, 123.
 Rajita, La, 174.
 Ralegh, Sir Walter, 8, 71, 74.
 Ramal de las Arenas, 165.
 Rambleta, crater, 16.
 Raminho, 306, 311.
 Rasca, Punta de la, 147, 148, 149.
 ray, giant, 242.
 Realejo, village, 58, 153, 165.
 Rebentão, 283.
 Recco, Niccoloso da, 54.
 Regla Bay, cable, 106, 107.
 Rejón, Juan, 57.
 Relva, 275, 298.
 Restinga, Punta, 189.
 retama, 45.
 Retorta, Agua, 283.
 — Ponta, 279.
Revenge, the, 7, 72, 74, 75.
 Reyes, Puerto de los, 189.
 rhododendron, 41.
 Ribeira Brava, conçelho, 231.
 — —, town, 224, 230, 248, 249, 250; population, 233; roads, 229, 253.
 — Chã, 297.
 —, Ponta da, 279.
 — Grande (S. Miguel), 275, 280, 281, 282; hospital, 82; linen, 285; population, 281, 284; roads, 295, 296, 297, 298, 299, 300, 301.
 — — (Pico), 317, 318.
 — Quente, 274, 279, 283, 298.
 — Seca (Madeira), 242, 249, 252.
 — Secca (Terceira), 311.
 — — (S. Miguel), 284, 299.
 Ribeiras (Pico), 322.
 —, Ponta das, 304.
 Ribeirinha (Fayal), 325, 327, 333.
 — (S. Miguel), 280.

 Ribeirinha (Terceira), 306.
 —, Ponta da (Fayal), 327.
 Richelieu, Cardinal, 53.
 Río, El (Tenerife), 147.
 — — —, barranco del, 45, 146.
 — (La Palma), barranco del, 180.
 Rio, Estrecho del, 209.
 —, Isla del, 209.
 — Palmo (Fuerteventura), barranco de, 195, 198, 200.
 — — —, hamlet, 195.
 — — —, Valle de, 200.
 Rios, Montaña de los, 186.
 Risco, El (Gran Canaria), 129, 140.
 —, Ribeiro do, 225, 237.
 Rocas Salmona, 49.
 Roi, Pico d' El, 274.
 Roida da Praia, 297.
 Roja, Montaña, 193.
 —, Punta, 149.
 Roosevelt, President F. D., 76.
 Roque, El, islet, 149.
 — de Bentayga, 117.
 — de los Muchachos, 177.
 — del Saucillo, 117, 118.
 — Infierno (Roque del Oeste), 218.
 — Negro, Punta, 123.
 — Nublo, 117, 121.
 Rosa, Punta de la, 123.
 Rosales, Ponta de, 315.
 Rosario (Corvo), 337, 338; radio, 351; wireless, 351.
 —, El (Tenerife), 152, 154.
 Rosas, Las, 176.
 Rubicón, Fort, 55, 210.
 Ruigomez, 165.
 Ruiva, 316.
 Ruivo, Pico, 224, 236.

 All place-names prefixed by S., São, Saint, San, Santa, St., &c., will be found indexed in alphabetical order immediately after the letter S.
 S. Amaro (Fayal), 327, 333.
 — (Pico), 319.
 S. Andrés (Hierro), 187, 189, 192.
 — (La Palma), 179, 183, 184.
 — (Tenerife), 144, 148, 151; population, 154; roads, 165.
 S. Antonio da Serra, 223, 224, 226, 232, 236; roads, 251, 253, 254.
 —, near Funchal (Madeira), 254.
 — (Pico), 321.
 S. Barbara, Caldeira de (Terceira), 17, 302, 303, 304, 305, 311.
 — (Lanzarote), castle, 215.
 — (S. Maria), 272.
 — (Terceira), 306, 311.
S. Barnabe, the, 74.
 S. Bartholomeu (Terceira), 306, 311.
 S. Bartolomé (Lanzarote), 205, 207, 208, 210, 214; roads, 214.

- S. Bartolomé de Tirajana (Gran Canaria), 139, 141; population, 129.
 S. Brandan, 54.
 S. Braz, 277, 278.
 S. Brigida, 121, 127, 140.
 S. Catalina, Puerto de (Puerto de la Luz), 136.
 S. Catarina, Ponta da (Madeira), 229.
 S. Christo, Caldeira do, 111.
 S. Cristóbal, fort (S. Cruz de Tenerife), 60.
 —, Punta de (Gomera), 171, 174.
 S. Cruz, Castello de (Fayal), 331, 332.
 — de La Palma, 78, 79, 177, 179, 180, 181; communications, 185, 186; description, 185; fishing, 184; population, 182; port, 181, 184, 185.
 — de Tenerife, city, 7, 8, 78, 126, 142, 148; cable, 106; cigarette factories, 157; commerce, 160; communications, 163; description, 160-3; fishing, 159; history, 57, 59, 160; hospital, 82; industry, 160; Nelson at, 59, 160; population, 150, 151, 152, 154, 160; port, 148, 160-3; port facilities, 163; radio, 348; water-supply, 144, 145; seaplane base, 163; telephone, 106, temperature, 30; visibility, 37; wireless, 348.
 — —, province, administration, 78-9; agriculture, 157-8.
 — (Flores), 334, 336; wireless, 351.
 — (Graciosa), 313, 314; radio, 313, 350; wireless, 350.
 — (Madeira), 229, 232, 251, 253.
 — — bay, 229.
 — —, concelho, 231.
 —, Marqués de, 70.
 S. Espírito, 272.
 S. Felipe, 125.
 S. Gabriel, Islote de, 209, 213, 214.
 S. Ginés, 212.
 S. Isabel dos Milagres, Capella de, 232.
 S. João Batista, 305.
 — —, Castello de, 308, 309, 310.
 — (Pico), 322; volcanic activity, 341.
 —, Ribeira de (Madeira), 242.
 S. Jorge (Azores), 6, 317; administration, 80; area, 267, 315; description, 315-16; history, 68, 69, 72; population, 267, 316; radio, 350; volcanic activity, 341; wireless, 350.
 — (Madeira), 226, 228, 234, 238.
 — —, Arco de, 233, 234.
 — —, Ponta de, 223, 228.
 — —, Ribeira, 15, 225, 228, 237.
 S. Juan de la Rambla (Tenerife), 153, 165.
 —, Puerto de (Tenerife), 149, 164, 166.
 S. Lorenzo (Gran Canaria), 127.
 S. Louis (Senegal), 107.
 S. Lourenço (S. Maria), 272.
 — — bay, 271, 272.
 — —, headland, 271.
 —, Ponta de (Madeira), 15, 61, 223, 228, 231.
 S. Lucia (Gran Canaria), 129, 141.
 S. Luzia (Pico), volcanic activity, 341.
 S. Marcos, Puerto de, 149, 154.
 S. Maria (Azores), 6, 67, 69; administration, 80; area, 267, 269; coasts, 271; communications, 272-3; description, 269-73; fishing, 272; formation, 14; industry, 272; longitude, 269; population, 267, 271-2; radio, 350; relief, 270; shipping, 104; vegetation, 270-1; water-supply, 270-1; wireless, 350.
 — del Carmen (Tenerife), 165.
 S. Martinho (Madeira), 232, 254.
 S. Matheus (Terceira), 304, 307.
 S. Mateo (Gran Canaria), 120, 121, 129, 138, 140, 141.
 S. Mateus (Pico), 319, 341.
 —, Ponta de (Pico), 322.
 S. Matriz church, 291, 294.
 S. Miguel (Azores), 6, 7, 48, 67, 68, 70; administration, 80; agriculture, 285-89; area, 267, 268, 274; coasts, 279-81; communications, 295-301; description, 274-301; drainage, 276-7; fishing, 289-90; formation, 13; history, 70, 76; industries, 285; lemons, 288; live-stock, 289; oranges, 288; pine-apples, 104; plague, 81; population, 267, 268, 281-5; ports, 290-5; quarrying, 285; radio, 349; relief, 274-5; manufacturing, 285; signal communications, 111; sugar-cane, 288; telephone, 109, 110; trade, 103; vegetation, 277-9; vine, 287; volcanic activity, 340; wireless, 349.
 —, Fuerte de (Tenerife), 162.
 — (Tenerife), population, 156; roads, 166.
 S. Nicolas de las Manchas (La Palma), 179, 180, 182, 186.
 S. Pedro (S. Maria), 272.
 S. Phelipe, the, 74.
 S. Roque (Madeira), 234, 254; roads, 249.
 — (Pico), 321, 322.
 — (S. Miguel), 280, 296.
 S. Sebastián (Gomera), 58, 78, 79, 168, 171; cable, 107; communications, 175-6; description, 174-5; drainage, 169; industries, 173-4; population, 172; port, 172, 174-5; salting factory, 174.
 S. Sebastião (Terceira), 70, 306, 311.
 S. Thomé, 3.
 S. Ursula (Tenerife), 153, 165.
 S. Vicente (Cape Verde islands), cable, 107, 108, 247.

- S. Vicente (Madeira), 224, 233; roads, 229, 248, 251, 253; vineyards, 239.
 — —, *conçelho*, 231.
 —, Ribeira de (Madeira), 15, 18, 225, 227, 229, 233, 234, 240, 253.
 —, (Tenerife), 153.
 S. Vincent, Cape (Portugal), 72.
 Sabinosa, 187, 190, 192.
 Sabrina island, submarine eruption, 342.
 Sail rock (Farilhão Testa), 261.
 Salão, 333.
 —, Ponta do, 327.
 Salga, 304.
 Salgo, 298.
 Salle, Gadifer de la, 55.
 Salmona, Punta, 187.
 Salvage islands, *see under* Selvagens.
 Sand-grouse, black breasted, 48.
 Santa Cruz de Tenerife, *see under* S. Cruz.
 Santana, 226, 228, 234, 237; *conçelho*, 231; roads, 247, 248, 252, 253.
 —, Ponta de, 224.
 Santiago (Gomera), 171, 173; roads, 176; salting factory, 174.
 — (Gomera), barranco de, 168.
 —, Forte de (Madeira), 108, 242, 247.
 — (Tenerife), 144, 149; population, 155; roads, 164; valley of, 166.
 — del Teide, 21, 165, 166.
 —, Valle de, 165.
 Santos, barranco de los, 145, 160.
 —, Serra, 300.
 Sardina, 119, 125.
 — bay, submarine cable, 106.
 sardines, 104, 134, 241.
 Saucos, Los, 179, 183.
 Saucillo, Roque del, 117.
 Sauzal, 150, 152.
 Saxton, Christopher, 269.
 scabbard-fish, 241.
 Se, Pico da, 334.
 sea-bream, 241.
 Seco, barranco, 172.
 Seixal, 224, 229, 233, 239.
 —, promontory, 228.
 —, Ribeira do, 225.
 Selvagem Grande, 222, 264-6; fauna, 49.
 — Pequena, 222, 264-6.
 Selvagens, the, 4, 222; description, 264-6.
Sempervivum (house-leek), 43, 44, 121, 169, 170.
 Sercial, wine, 239.
Serpent, the, 71.
 Serreta, Ponta da, 304.
 Sesostris, King of Egypt, 53.
 Sete Cidades, 277, 281, 284, 301.
 — —, Caldeira das, 68, 275, 276, 278, 280, 301; volcanic activity, 340; crater lake, 17.
 Seville, 58.
 shark, basking, 289.
 shearwater, 204, 217, 218, 263, 266.
 —, Allied, 49.
 —, Canary, 219.
 —, great, 49.
 —, little, 49.
 Shilloucks, 84.
 Siete Fuentes, 21.
 Silos, Los, 154.
 Silva, barranco de, 122.
 —, D. Diogo da, 56.
 Simanco, barranco, 176.
 Sisal hemp, 201.
 snipe, 49.
 Socorridos, Ribeira dos, 224, 225, 227, 230, 232, 250.
 Socorro, El, 152.
 Sodr , Vasco Gil, 68.
 Sol, Ponta do, 224, 225, 230, 233, 250; jetty, 242.
 —, — —, *conçelho*, 231.
 Sold o, lava-flow, 341.
 —, — —, ribeira da, 225.
 Somodita, La, 164, 166.
Sonchus spinosus, 44, 197.
sphagnum moss, 279, 304, 321.
 spurge, Canary, 44.
Styx, H.M.S., 318.
 sugar, 7, 121, 130, 133, 140, 184, 346.
 — beet, 7, 285, 286, 306.
 — cane, 44, 63, 68, 102, 103, 125, 126, 128, 154, 233, 236, 238, 243.
 sulphur, 14, 98, 156, 277, 346.
 swordfish, 242.
 tabayba, 44.
 Tablero, El, radio, 348; telephone, 106; wireless, 348.
 Tabouriente, Gran Caldera de, 17, 177.
 Tabua, 233.
 —, Ribeira da, 250.
 Taco, Mont a del, 154, 166.
 Tacoronte, 16, 20, 163, 164, 165; lava-cliffs, 20; population, 151, 152; roads, 166; water tanks, 145.
 Tafira, 126, 127; caldera, 17.
 — Alta, 140.
 — Baja, 140.
 Taganana, 151.
 Tagasniche, 168.
 —, mountains, 172.
 Tahiche, 208, 210, 215.
 Tahodio, presa de, 145.
 Taidia, 129.
 Tajuya, 182, 186.
 Tamadaba, Punta, 123.
 Tamaimo, headland, 149.
 Tamanca, 181.
 Tamaraceite, 124, 125, 138, 140.
 tamarind, 130, 236.
 tamarisk, 44, 120, 169, 195, 208.

- Tangier, 25.
 Tanque, El, 165.
 Taoro, Mencey of, 91.
 —, Monte, 21.
taoros, 91.
 Tarajalejo, Puerto, 198.
 Tazacorte, 177, 179, 181, 182, 184, 186.
 —, Puerto de, 184.
 tea, 42, 104, 288, 293.
 Tefia, 193, 203.
 Tegueste, 151, 152.
 — bay, 150.
 Teguisse, 205, 207, 208, 209, 210, 214; roads, 214, 215.
 Teide, Pico de, *see under* Pico de Teide.
 Tejeda, caves, 20; population, 129; roads, 139, 140.
 —, barranco de, 117.
 Tejina, 151; water-tanks, 145.
 —, La, bight of, 150.
 Tejita, 107; cables, 175.
 Telde, 118, 119, 120, 129, 133; population, 127; roads, 122, 138, 141.
 —, barranco Real de, 126, 127.
 Temisa, 211.
 Tenefé, Puerto, 122.
 Tenerife (Teneriffe), 4; administration, 78; agriculture, 157-9; area, 115; coasts, 147-50; communications, 164-7; description, 142-67; drainage and water-supply, 144-7; fauna, 48, 49; fishing, 159; flora, 41; forests, 47; formation, 13; geological history, 12; history, 57, 58; industries, 156-9; livestock, 159; manufacturing, 157; mining, 156; Nelson and, 59-60; population, 115, 150-6; ports, 160-3; radio, 348; relief, 6, 142-4; signal communications, 106, 108; sulphur deposits, 14; temperature, 31; vegetation, 42-5, 147; volcanic activity, 20; wireless, 348.
 Tenerro, 186.
 Tenizca, 182.
 —, barranco, 177, 186.
 Teno, peninsula, 144, 165.
 —, Bajo, 144.
 —, Punta de, 147, 149, 154.
 Tenoya, 140.
 Terceira, island, 6, 68; administration, 80; area, 267; coasts, 304-5; communications, 310-12; description, 302-12; discovery, 67; drainage, 303; history, 69, 70, 72, 75, 76, 309; industries, 306; livestock, 307; population, 267, 305-6; ports, 7, 307; radio, 350; relief, 302-3; telephone, 109, 110; vegetation, 303-4; volcanic activity, 340; wireless, 350.
 —, Duke of, 306.
 tern, 48.
 Ternero, headland of, 148.
 Teror, 119, 120, 121, 126; roads, 140, 141.
 Terra Cha, 306.
 Teseguite, 211.
 Tetir, 199, 203.
Thymus serpyllum, 304.
 Tiagua, 207, 214.
 Tias, 208, 210, 214; roads, 214.
 Tígalate, 21, 179.
 Tijarafe, 179, 183.
 til, 42, 46, 47, 227.
 Time, El, 177, 182, 183, 186.
 Tinajo, 207, 210; roads, 214.
 Tindaya, 203.
 Tiñor, 189, 192.
 Tiñosa, La, 209.
 Tinta, wine, 239.
 Tirajana, 87, 121, 128; roads, 141.
 —, barranco de, 117, 118, 122, 126, 128, 129.
 Tirma, 129.
 —, Montaña de, 123.
 Tiscamanita, 196.
 tobacco, in Azores, 7, 42, 104, 285, 293, 306, 323.
 —, in Canaries, 44, 129, 130, 133, 156, 157, 182, 183, 185, 211, 346, 347.
 —, in Madeira, 42.
 Toledo, treaty of, 57.
 tomato, 7, 60, 99, 128, 129, 130, 132, 136, 151, 153, 155, 156, 158, 163, 171, 172, 173, 182, 184, 185, 200, 202, 211, 347.
 Tôpo, islet (S. Jorge), 315.
 —, village, —, 69, 316.
 —, Pico (Pico), 318, 322.
 —, Ponta do (S. Jorge), 315.
 Tornozellos, Pico dos, 265.
 Torrais, Ponta do, 337.
torral, 29.
 Torre, barranco de la, 195, 199.
 Tostón, 193, 198, 200, 203.
 —, cove, 198.
 —, Puerto de, 201.
 —, Punta de, 198.
 Toto, 196.
 Trapiche, 125.
 Triana, 79, 135.
 Tristão, Ponta do, 228, 229.
 Troubridge, Captain, 60.
 trumpeter bullfinch, 48.
 Tuineje, 196, 198, 199, 200, 202, 203.
 tulip tree, 40.
 tunny, 134, 159, 174, 241, 242, 289, 328; canned, 102, 104.
 turtle, loggerhead, 50, 241.
 Twain, Mark, 95.
 Uga, 207, 212, 214.

- Val, Ponta, 304.
 Vallegranrey, 171, 173; roads, 176; salting factory, 174.
 —, barranco de, 168.
 Vallehermoso, 169, 171, 173, 174; population, 172; roads, 175; valley, 176.
 Valleseco, 119.
 Valles, Los, 215.
 Valsequillo, 129.
 Valverde, 78, 79, 187, 188, 189, 191, 192.
 Vara, Pico da, 274.
 Varadouro, Ponta do, 327.
 Varadouros, Ponta dos, 257.
 Vaz Tristão, 61, 62.
 Veado, Pico de, 265.
 Vega, the (Gran Canaria), 120.
 —, Valle de la (Tenerife), 145, 148.
 Vegueta, 79, 135.
 Vellas (S. Jorge), 110, 315, 316; radio, 350; volcanic activity, 341; wireless, 350.
 Vera, Pedro de, 57.
 Verdelho, wine, 240.
 Verrier, Jean le, 83.
 Viburnum, 277, 278.
 Victoria, 313.
 Victoria de la Acentejo, 153, 165.
 Vidal, Captain Alexander, 318.
 Vila Baleira (Porto Santo), 108, 221, 257, 258, 259; population, 258; radio, 349; wireless, 349.
 — de Vellas, *see under* Vellas.
 — do Porto, 271, 272; radio, 350; wireless, 350.
 — — — bay, 271.
 — Franca, bay, 279.
 — —, island, 279, 280.
 — — do Campo, 68, 279, 281, 282, 291, 296, 297; basin, 290; history, 70, 282; hospital, 82; oranges, 288; pineapple, 287; roads, 295, 296, 297, 299; volcanic activity, 340.
 Vila Nova, 310, 311.
 —, Ponta da, 305.
 —, Ribeira da, 258.
 Vilaflor, population, 156; roads, 164, 166; temperature, 31.
 Vilhena, Maria de, 69.
 Villa, barranco de, 168.
 — Flor, Count of, 306.
 —, Montaña la, 199.
 viñatigo (vinatico), 39, 42, 227, 278.
 vine, in Azores, 7, 272, 287, 306, 337.
 —, in Canaries, 44, 130, 156, 158, 172, 184, 211, 212.
 —, in Madeira, 7, 236, 238, 259.
 viola, 45.
 Vivaldi, 54.
 walnut, 44, 240.
 War, of 1914-18, 8, 66, 76, 309; Napoleonic, 8.
 West Indies, British, 323.
 whale, spermaceti, 290.
 whale-oil, 290, 293, 331.
 whaling, 104, 290.
 wheat, in Azores, 7, 42, 103, 272, 286, 287, 294, 306, 314, 331, 337.
 —, in Canaries, 44, 152, 154, 158, 173, 201, 211, 212.
 —, in Madeira, 238.
 whitebait, 241.
 wine, 7, 190, 246, 346.
 —, Madeira, 239-40.
 Winton, Admiral Charles, 59.
 wistaria, 41.
 woodcock, 48, 49.
 yam, 44, 233, 236, 240.
 Yaiza, 18, 210, 214.
 Yé, 215.
 yeso, 200.
 Zarco, João Gonçalves, 61, 62, 63, 64; tomb of, 243.
 Zurara, 64.

